

**QUALITY ASSURANCE SAMPLING PLAN**  
**FOR**  
**LARD OIL COMPANY OIL SPILL**  
**914 FLORIDA STREET**  
**DENHAM SPRINGS, LIVINGSTON PARISH, LOUISIANA**

Prepared for

**U.S. Environmental Protection Agency Region 6**  
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## 1. INTRODUCTION

Weston Solutions, Inc. (WESTON®), the Superfund Technical Assessment and Response Team (START-3) contractor (EPA team), has been verbally tasked by the U.S. Environmental Protection Agency (EPA) Region 6 Emergency Management Branch (EMB) under Contract Number EP-W-06-042, to perform oil spill sampling activities associated with the Lard Oil Company oil spill located at 914 Florida St., Denham Springs, Livingston Parish, Louisiana (see Figure 1-1). This Quality Assurance Sampling Plan (QASP) has been prepared to describe the sampling and analytical scope of work to be completed as part of the emergency response activities.

### 1.1 PROJECT OBJECTIVES

START-3 is providing technical assistance to EPA Region 6 by performing emergency response activities to collect the data necessary to support a determination by EPA that the site presents a threat to public health or welfare of the United States or the environment in accordance with *40 Code of Federal Regulations (CFR) 300.415 and Clean Water Act (CWA), 33 U.S.C. § 1321, ET SEQ, as amended by the Oil Pollution Act of 1990 (OPA 90)*.

The project objective of the Oil Spill Response is to determine the nature and extent of site-related oil contamination.

The project objective will be achieved by conducting the following activities:

- Collection and laboratory analysis of oil identification/presence samples. Multi-media (soil, sediment and vegetation) samples will be collected from flood impacted areas affected by the oil spill scene.
- Collection and laboratory analysis of comparative oil fingerprint samples, which include spill-source samples collected from the Lard Oil Company facility and multi-media samples collected from materials located within potential off-site migration areas.
- Collection and laboratory analysis of indoor wipe samples from nearby residential/commercial building materials impacted by the flood. Wipe samples will be



analyzed for TPH s (DRO & ORO) constituents. The EPA Team will collect confirmation wipe samples from the same residential homes and commercial businesses as the Responsible Party (RP) to ensure data reliability and quality assurance.

- Review and evaluation of samples data compared to RP data results and compared to Louisiana Department of Environmental Quality (LDEQ), Risk Evaluation/Corrective Action Program (RECAP), October, 2003.

Commented [WJ1]: Need to confirm this with OSC.

The EPA team will achieve these objectives to determine if further action is required or if no further action is warranted.

## 1.2 PROJECT TEAM

The EPA team will be led by EPA OSC Bryant Smalley and will consist of a Project Team Leader (PTL) and Field Safety Officer (FSO) and additional EPA team members as needed. The PTL will be responsible for the technical quality of work performed in the field and will serve as the START-3 liaison to EPA Region 6 in the field during the site activities. The PTL, with the concurrence of EPA, will determine the precise locations for sample collection in the field, collect samples as necessary, log the activities at each sample location in the field logbook, and verify the sample documentation. The PTL will be responsible for entering all samples collected into SCRIBE and producing accurate Chain-of-Custody (COC) documentation for the samples during the collection activities. The PTL will also be responsible for entering daily operations and sample collection data into the Regional Response Center - Enterprise Data Management System (RRC-EDMS) Response Manager. Additionally, the project-specific website on epaosc.net will be kept up-to-date. The PTL will also oversee the packaging and shipping of samples to the EPA-approved laboratory.

## 1.3 QASP FORMAT

This QASP has been organized in a format that is intended to facilitate and effectively meet the objective of the sampling action. The QASP is organized as follows:

- Section 1 – Introduction
- Section 2 – Site Description and Background

- Section 3 – Sampling Approach and Procedures
- Section 4 – Analytical Methods and Data Validation
- Section 5 – Quality Assurance

Appendices are attached with the following information:

- Appendix A – Site-Specific Data Quality Objectives
- Appendix B – Standard Operating Procedures
- Appendix C – TDD No. Pending

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## 2. SITE DESCRIPTION AND BACKGROUND

On August 18, 2016, EPA responded to a report of an oil spill from Lard Oil Co., located at 914 Florida Ave. SW, in Denham Springs, Livingston Parish Louisiana. The facility is an active petroleum, oil and lubricant (POL) packaging company that provides repackaging of bulk POL materials into custom, distributable products for the consumer marketplace. Slow-moving storms resulted in more than two feet of rain around Denham Springs August 13-14, 2016, causing flooding of the Amite River. Floodwaters displaced oil containers and discharged up to 2,150 gallons of engine lubrication oils from the facility to the surrounding neighborhood. Affected homes and businesses appear to be primarily southeast of the facility along (b) (6) streets as well as several cross streets to (b) (6) (see Figure 2-1).

Discharged oil impacted homes, businesses, vegetation and yards before being carried away in floodwaters. Stormwater drains to Grays Creek to the east, then southward to the Amite River which flows east to Lake Maurepas and Lake Pontchartrain, which meet the definition of “navigable waters” of the United States (US) as defined in Section 502(7) of the Federal Water Pollution Control Act (FWPCA).

### 3. SAMPLING APPROACH AND PROCEDURES

The specific field investigation activities that will be conducted during the sampling process are presented in the following subsections. Sampling procedures are also included. Sample locations will be determined in the field based on visible evidence of oil. Samples will be analyzed by the following laboratory methods:

- Oil Identification and Comparative Oil Fingerprint Analysis (U.S. Coast Guard Marine Safety Laboratory) for spill-source liquid and multi-media (soil, sediment and vegetation) samples.
- Total Petroleum Hydrocarbons (TPH) - Diesel Range Organics (DRO) and Oil Range Organics (ORO), EPA Method 8015 for indoor wipe samples.

#### 3.1 OVERVIEW OF SAMPLING ACTIVITIES

The nature and extent of site-related contamination will be evaluated by collecting and analyzing multi-media samples from field-selected locations where migrating oils accumulated on residential and commercial properties and in stormwater ditches downstream of the Lard Oil facility.

##### 3.1.1 Health and Safety Plan

The EPA team developed a specific task associated with multi-media sampling. This task has been incorporated into the overall Health and Safety Plan (HASP) developed during the emergency response.

##### 3.1.2 Data Quality Objective

The objectives of the sampling activities are three-fold: 1) to collect data that identifies whether downstream soil, sediment, and/or housing and building materials have been affected as a result of an oil release from the Lard Oil facility, 2) to compare analytical fingerprint data of samples collected from within the Lard Oil facility and from within the suspected migration area, and 3) to assist in the quality assurance of the sampling procedures and laboratory analytical data of Responsible Party (RP) via split sampling, allowing an evaluation of the reproducibility of results. The Data Quality Objectives (DQOs) for this data were developed using the seven-step

process set out in *EPA Guidance for Quality Assurance Project Plans: EPA QA/G-5* and is included as Appendix A.

### **3.1.3 Field Activities Review Meeting**

Prior to mobilizing to the site, the PTL will conduct a meeting with the field team to familiarize them with the project scope of work, to discuss the planned field activities and roles and responsibilities, and to review the project Health and Safety Plan (HASP) and other relevant operating procedures.

## **3.2 SAMPLING PLAN DESIGN AND METHODS**

Sampling will be conducted in general accordance with the EPA *Compendium of Emergency Response Team (ERT) Soil Sampling and Surface Geophysics Procedures* and with WESTON and EPA ERT Standard Operating Procedures (SOPs) (Appendix B). SOPs include WESTON SOPs No. 1001.01 and 1002.04 (Surface Soil and Sediment Sampling) and EPA ERT SOP 2011 (Chip, Wipe, and Sweep Sampling). The specific sampling, decontamination, and sample handling procedures, including disposition of investigation-derived waste (IDW), are described in the following subsections. The following subsections describe the proposed sampling, sample handling procedures and field quality control (QC) samples for the removal assessment activities. The EPA OSC will be notified, and concurrence will be obtained should significant deviations from the planned sampling activities be proposed. Details regarding deviations of the QASP will be documented in the START-3 site logbook.

### **3.2.1 Soil, Sediment, and Vegetative Sampling**

The EPA team will collect soil, sediment, and vegetation samples in support of the Lard Oil Company Oil Spill response activities. It is estimated that up to 20 of these types of samples (Multi-media) will be collected. Biased, grab surface soil samples will be collected from areas on the Lard Oil facility where visual evidence suggests that POL products have spilled onto the ground. In addition, liquid oil samples will be collected from bulk containers that Lard Oil representatives identified as containing similar oil as containers that spilled their contents. EPA will also collect biased, grab soil, sediment and vegetation samples from residential, commercial

and stormwater ditches that showed visual evidence of the presence of oil spill material. Soil and sediment samples will be collected 0 to 3 inches below ground surface utilizing disposable plastic scoops. Vegetative samples will include the collection of affected leaves/foilage material. Samples will be collected in the appropriate sample containers and submitted to the United States Coast Guard Marine Safety Laboratory in New London, Connecticut for analysis. Sampling personnel will change gloves between each sample collection location and between sample handling activities. Samples will be assembled and catalogued prior to shipping to the designated laboratory (following WESTON SOP 1101.1 and 1102.01). Applicable SOPs are included in Appendix B.

### **3.2.2 Housing-Material Wipe Samples**

The EPA team will also collect split indoor residential/ commercial building-material wipe samples. It is estimated that up to 10 of these types of samples will be collected. The samples will be collected in general accordance with EPA ERT SOP 2011 (Chip, Wipe, and Sweep Sampling). A 10-centimeter square gauze dampened with deionized water will be used to wipe the designated surface area of the most likely affected indoor materials. Each wipe sample will be collected over standard 10-centimeter by 10-centimeter surface area. The gauze will then be placed in clean, laboratory-prepared containers. Sampling personnel will change gloves between each sample collection location and between sample handling activities. The samples will be submitted to ALS Laboratory in Houston, Texas for Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO) and Total Petroleum Hydrocarbons – Oil Range Organics (TPH-ORO) analyses by EPA Method 8015. Samples will be assembled and catalogued prior to shipping to the designated laboratory (following WESTON SOP 1101.1 and 1102.01). Applicable SOPs are included in Appendix B.

### **3.2.3 Investigation-Derived Waste**

Attempts will be made to eliminate or minimize the generation of investigation-derived waste (IDW) during the investigation. The analytical data from the collected samples will be reviewed after the completion of the field activities, and disposal options will be evaluated accordingly.

### **3.2.4 Sampling and Sample Handling Procedures**

The volume of the sample collected will be sufficient to perform the analysis requested. Samples will be stored in the proper types of containers and preserved in a manner for the analysis to be performed as indicated in Table 3-1.

All clean, decontaminated sampling equipment and sample containers will be maintained in a clean, segregated area. All samples will be collected with clean, dedicated sampling equipment. All samples collected for laboratory analysis will be placed directly into pre-cleaned, unused containers. Sampling personnel will change gloves between each sample collection/handling. All samples will be assembled and catalogued prior to shipping to the designated laboratories.

### **3.2.5 Quality Assurance/Quality Control Samples**

The EPA team will collect field duplicate samples during the assessment sampling activities as part of the Quality Assurance/Quality Control (QA/QC) program (SOP 1005.01). Matrix spike/matrix spike duplicates will not be collected per conversations with the U.S. Coast Guard Marine Safety Laboratory and ALS Laboratory. QA/QC samples will be collected according to the following protocol:

- Blind field duplicate sediment samples will be collected during sampling activities at locations selected by the START-3 PTL. The data obtained from these samples will be used to assist in the quality assurance of the sampling procedures and laboratory analytical data by allowing an evaluation of reproducibility of results. Efforts will be made to collect duplicate samples in locations where there is visual evidence of contamination or where contamination is suspected. Blind field duplicate samples will be collected at the rate of 1 duplicate for every 10 samples collected.

## **3.3 SAMPLE MANAGEMENT**

Specific nomenclature that will be used by the EPA team will provide a consistent means of facilitating the sampling and overall data management for the project as defined in the SOPs (Appendix B). Any deviations from the sample nomenclature proposed below must be pre-approved. The general nomenclature consists of the following components:

- Geographic location or on-site sample location.
- QA/QC type (normal, duplicate, rinsate blank, etc.).

- Sequence (e.g., which sample it represents).
- Date (of sampling activity).

The following presents the sample nomenclature for analytical samples that will generate unique sample names compatible with most data management systems. The sample nomenclature is based upon specific requirements for reporting these results.

#### SAMPLE NOMENCLATURE – SOIL, SEDIMENT and VEGETATION

(b) (6)

**Where:**

**Property ID:**

An identifier used to designate the particular property or Area of Concern (AOC) where the sample was collected.

**Numerical Sequence:**

An ascending number beginning with '1' used to designate the sample numerical position within the total number of samples collected.

**QC Type:**

A one-digit code used to designate the QC type of the sample

**MMDDYYYY:**

The date that the sample was collected, beginning with the 2-digit numerical month and date and the 4-digit year.

**Examples:**

- (b) (6) Represents the normal soil sample collected from the Lard Oil facility.

#### 3.4 DECONTAMINATION

Decontamination of sampling equipment is not anticipated for this sampling event. The EPA team will use dedicated sampling equipment whenever possible. If the use of non-dedicated sampling equipment is required during the sample collection process, that equipment will be thoroughly decontaminated before initial use, between use, and at the end of the field investigation. If required, non-dedicated equipment decontamination will be completed in the following steps:

1. Non-phosphate detergent and potable water wash to clean the equipment.
2. Final potable water rinse.
3. Equipment air-dried.



If required, decontamination activities will be conducted at a temporary decontamination pad that will be constructed in an area identified prior to the beginning of field activities (SOP 1201.01).

In the event of equipment decontamination, excess oil and fluids generated as a result of decontamination will be placed in a drum and staged on-site. The drum will be labeled on the side with the name of the site, the contents, sampling locations, and date.

### **3.5 SAMPLE PRESERVATION, CONTAINERS, AND HOLD TIMES**

Once collected, samples will be stored in coolers and kept at approximately 4°C while at the site and until they are submitted for analysis. Chain-of-custody (COC) forms will be completed for each sample shipment and sent with the samples to the designated laboratory. Samples that have been analyzed will be disposed of by the designated laboratory in accordance with the laboratory SOPs.

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**Table 3-1**  
**Requirements for Containers, Preservation**  
**Techniques, Sample Volumes, and Holding Times**

Name	Analytical Methods	Container <sup>a</sup>	Preservation	Minimum Sample Volume or Weight	Maximum Holding Time
Oil Identification and Fingerprint Analysis	U.S. Coast Guard Marine Safety Laboratory	Four 40-ml vials, ¾ full	4°C	120 milli-liters	Not Defined
Wipe Samples - Total Petroleum Hydrocarbons (TPHs) – DRO and ORO	SW-846, Method 8015	One 4-oz jar	4°C	10-cm sterile gauze	14 days to extraction and 40 days to analysis

Notes:

<sup>a</sup> glass.

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#### 4. ANALYTICAL METHODS AND DATA VALIDATION

Soil, sediment, and vegetation samples collected by the EPA team will be analyzed by the U.S. Coast Guard Marine Safety Laboratory located in New London, Connecticut. The following methods of analyses will be conducted:

- Oil Identification and Comparative Oil Fingerprint Analysis

Residential and Commercial building material wipe samples collected by the EPA team will be analyzed by ALS Laboratory located in Houston, Texas. The following methods of analysis will be conducted:

- Total Petroleum Hydrocarbons – Diesel Range Organics (DRO) and Oil Range Organics (ORO): EPA Method 8015

START-3 will validate the analytical data generated by ALS and provide an evaluation of QA/QC samples for reporting purposes. Data validation will be conducted in accordance with the EPA CLP *National Functional Guidelines for Organic Superfund Data Review – August 2014* (EPA-S40-R-014-002). A summary of the data validation findings will be presented in Data Validation Summary Reports as part of the final report. The following will be evaluated to verify that the analytical data is within acceptable QA/QC tolerances:

- The completeness of the laboratory reports, verifying that required components of the report are present and that the samples indicated on the accompanying chain-of-custody are addressed in the report.
- The calibration and tuning records for the laboratory instruments used for the sample analyses.
- The results of internal standards analyses.
- The results of laboratory blank analyses.
- The results of laboratory control sample (LCS) analyses.
- The results of matrix spike/matrix spike duplicate (MS/MSD) analyses.
- The results of surrogate recovery analyses.
- Compound identification and quantification accuracy.
- Laboratory precision, by reviewing the results for blind field duplicates.
- Variances from the QA/QC objectives will be addressed as part of the Data Validation Summary Reports.

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## 5. QUALITY ASSURANCE

Quality assurance will be conducted in accordance with the WESTON Corporate Quality Management Manual, dated September 2012; the WESTON Programmatic Quality Assurance Project Plan (QAPP), dated December 2009; and the WESTON Quality Management Plan, dated July 2009. Following receipt of the TDD from EPA, a Quality Control (QC) officer will be assigned and will monitor work conducted throughout the entire project including reviewing interim report deliverables and field audits. The EPA team PTL will be responsible for QA/QC for the field investigation activities. The designated laboratory utilized during the investigation will be responsible for QA/QC related to the analytical work. The EPA team will also collect samples to verify that laboratory QA/QC is consistent with the required standards and to validate the laboratory data received.

### 5.1 SAMPLE CUSTODY PROCEDURES

Because of the evidentiary nature of sample collection, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. After sample collection and identification, samples will be maintained under COC procedures. If the sample collected is to be split (laboratory QC), the sample will be allocated into similar sample containers. Sample labels completed with the same information as that on the original sample container will be attached to each of the split samples. All personnel required to package and ship coolers containing potentially hazardous material will be trained accordingly.

The EPA team will prepare and complete COC forms using the SCRIBE environmental sampling data management system for all samples sent to a START-3 designated off-site laboratory. The COC procedures are documented in WESTON SOP 1101.01, and will be made available to personnel involved with the sampling. A typical COC record will be completed each time a sample or group of samples is prepared for shipment to the laboratory. The record will repeat the information on each sample label and will serve as documentation of handling during shipment. A copy of this record will remain with the shipped samples at all times, and another copy will be retained by the member of the sampling team who originally relinquished the samples. At the

completion of the project, the Data Manager will export the SCRIBE COC documentation to the Analytical Service Tracking System (ANSETS) database.

Samples relinquished to the participating laboratories will be subject to the following procedures for transfer of custody and shipment:

- Samples will be accompanied by the COC record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. The custody record documents the transfer of sample custody from the sampler to another person or to the laboratory.
- Samples will be properly packed for shipment and dispatched to the appropriate laboratory for analysis with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be custody-sealed for shipment to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be sealed to ensure that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape.
- If sent by common carrier, a bill of lading or air bill will be used. Bill of lading and air bill receipts will be retained in the project file as part of the permanent documentation of sample shipping and transfer.

SOPs 1101.01 and 1102.01 describe these procedures in more detail.

## 5.2 PROJECT DOCUMENTATION

Documents will be completed legibly in ink as well as by entry into field logbooks, Response Manager, or SCRIBE. Response Manager is the Enterprise Data Collection System designed to provide near real-time access to data normally collected in logbooks. Response Manager provides a standard data collection interface for modules of data normally collected by EPA team field personnel while on-site. These modules fall into two basic categories for response and removal. The modules include Emergency Response, Reconnaissance, Facility Assessment, Shipping, Container, Materials, Calls, HHW, and General/Site-Specific Data. The system provides users with a standard template for laptop/desktop/tablet PCs that will synchronize to the secure web interface using merge replication technology to provide access to collected data via the RRC-EDMS EPA Web Hub. Response Manager also includes an integrated GPS unit with the secure PDA application, and the coordinates collected in Response Manager are

automatically mapped on the RRC-EDMS interactive mapping site. GIS personnel can access this data to provide comprehensive site maps for decision making support.

Response Manager also includes an analytical module that is designed to give SCRIBE users the ability to synchronize the SCRIBE field data to the RRC-EDMS Web Hub. This allows analytical data managers and data validators access to data to perform reviews from anywhere with an available Internet connection. The analytical module is designed to take the analytical data management functionality of the EPA SCRIBE software and make it available for multiple users to access on one site. Response Manager also supports EPA standards such as ANSETS and SEDD and will allow users to connect to the database using the SCRIBE desktop interface, thus providing normal SCRIBE desktop-like functionality for multiple users.

### 5.3 FIELD DOCUMENTATION

The following field documentation will be maintained as described below.

#### Field Logbook

The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. Each individual will sign any entry he/she makes. Entries will include, at a minimum, the following:

- Site name and project number.
- Names of on-site personnel.
- Dates and times of all entries.
- Description of all site activities, including site entry and exit times.
- Noteworthy events and discussions.
- Weather conditions.
- Site observations.
- Identification and description of samples and locations.
- Subcontractor information and names of on-site personnel.
- Dates and times of sample collections and chain-of-custody information.
- Records of photographs.
- Site sketches.
- Calibration results.

### **Sample Labels**

Sample labels will be securely affixed to the sample container. The labels will clearly identify the particular sample and will include the following information:

- Site name and project number.
- Date and time the sample was collected.
- Sample preservation method.
- Analysis requested.
- Sampling location.

### **Chain-of-Custody Record**

A chain-of-custody will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of each record will be kept by the signing individual. The chain-of-custody is discussed in Subsection 5.1 Sample Custody Procedures.

### **Custody Seal**

Custody seals demonstrate that a sample container has not been tampered with or opened. The individual who has custody of the samples will sign and date the seal and affix it to the container in such a manner that it cannot be opened without breaking the seal.

### **Photographic Documentation**

EPA team members will take photographs to document site conditions and activities as work progresses. Initial conditions should be well documented by photographing features that define the site-related contamination or special working conditions. Representative photographs should be taken of each type of site activity. The photographs should show typical operations and operating conditions as well as special situations and conditions that may arise during site activities. Site final conditions should also be documented as a record of how the site appeared at completion of the work.

All photographs should be taken with either a film camera or digital camera capable of recording the date on the image. Each photograph will be recorded in the logbook and within Response



Manager with the location of the photographer, direction the photograph was taken, the subject of the photograph, and its significance (i.e., why the picture was taken). Where appropriate, the photograph location, direction, and subject will also be shown on a site sketch and recorded within Response Manager.

### **Response Manager**

START-3 will use the Response Manager module located on the EPA Web Hub, <https://solutions.westonproject.net/epawebhub/>, to compile and organize the data collected from project activities. The information to be included encompasses some or all of the following depending on the specific project needs:

- General Module – site-specific data including location and type of site. It also includes an area for key site locations including geo-spatial data associated with the key site locations.
- Emergency Response Module – includes the following sub-modules: Basic Info, HAZMAT, Release, Time Line Log, Incident Zones, Photos, Sensitive Receptors, Evacuations, Source, Cause, and Weather.
- Reconnaissance Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for targeted reconnaissance efforts. Typically the data in this module is associated with ESF-10 deployments and the clean-up of orphaned containers and hazardous debris, but the module can be utilized for any or all reconnaissance activities.
- Facility Assessment Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for assessments of structures. Typically utilized for EPA regulated program facilities during an ESF-10 deployment of resources. This module can be utilized to track the assessment of any facilities including multiple assessments of the fixed facilities.
- Shipping Module – provides standard templates for creating a cradle-to-grave record of all waste shipments from the site until they are recycled or destroyed. This includes the ability to capture manifests and manifest line items and upload photos/original documents to support the records.

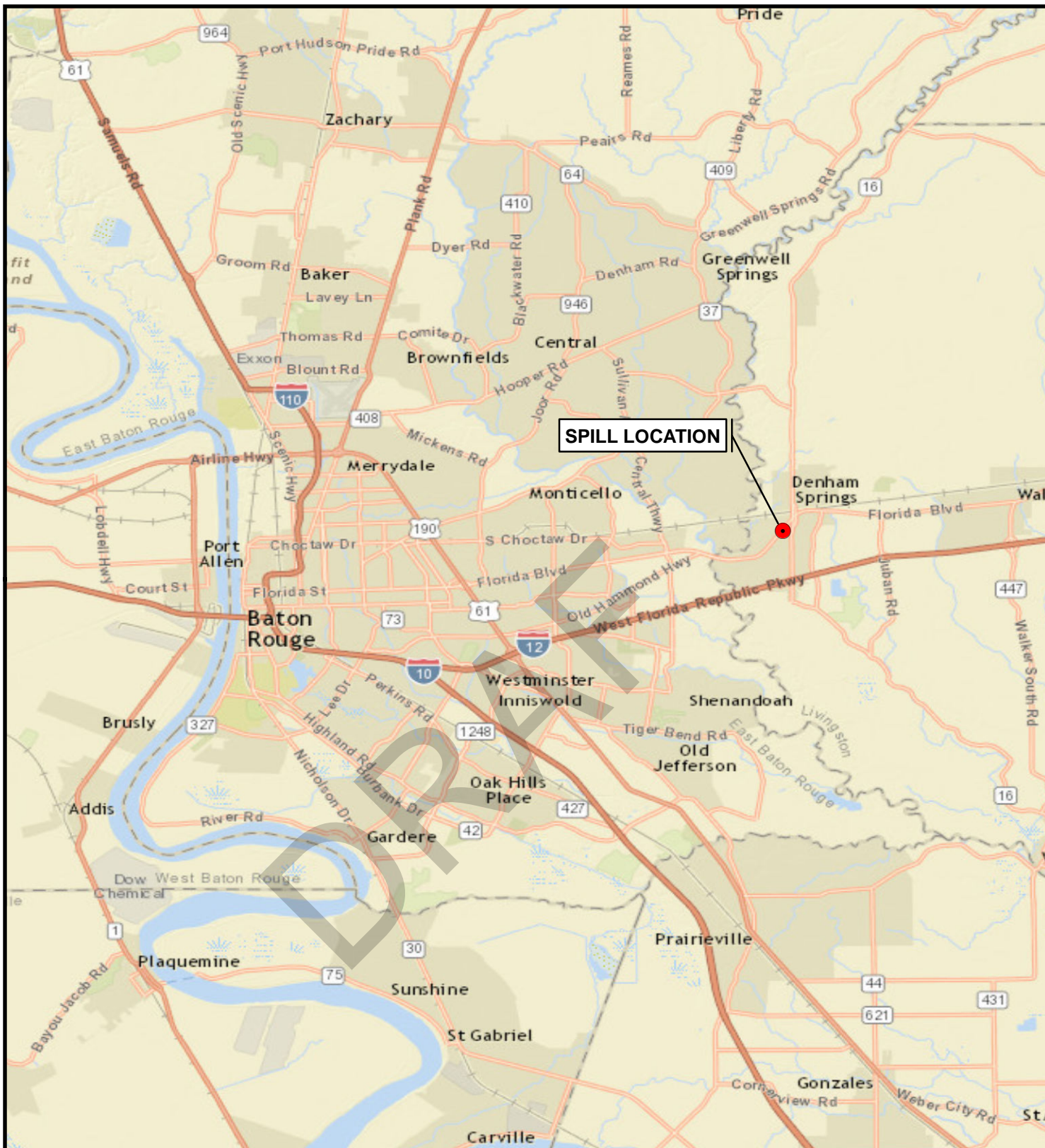
- Container Module – provides standard templates for cataloguing containers including HAZCAT and Layer information in each container. The module also allows for tracking which containers are bulked.
- Properties Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for collection of property data including access agreements and assessments of the property and current status of property regarding the site removal action.
- Materials Module – provides standard templates for tracking materials that are brought on-site or that are removed from the site.
- Daily Reports – provides standard templates for tracking daily site activities, daily site personnel, and daily site notes for reporting back to the EPA OSC in a POLREP or SITREP.
- HHW Module – provides standard templates with the flexibility of adding any additional questions of values to the drop-down lists for tracking the amount of HHW collected at individual collection stations by HHW type.
- Data Files – data files can be uploaded in the photo module section and be associated with individual records or with the site in general. The meta-data associated with that data file can be filled in using the photo log fields.

The data stored in the Response Manager database can be viewed and edited by any individual with access rights to those functions. At any time deemed necessary, POLREP and/or SITREPs can be generated by exporting the data out of Response Manager into Microsoft Excel/Word. The database is stored on a secure server and backed up regularly.

#### **5.4 REPORT PREPARATION**

At the completion of the project, EPA team members will review and validate all laboratory data and prepare a draft report of field activities and analytical results for EPA OSC review. Draft deliverable documents will be uploaded to the EPA TeamLink website for EPA OSC review and comment.

## FIGURES



## LEGEND

● SITE LOCATION



0 4 8  
SCALE IN MILES



US EPA REGION 6

FIGURE 1-1  
SITE LOCATION MAP  
LARD OIL COMPANY OIL SPILL  
914 FLORIDA AVE SW  
DENHAM SPRINGS, LIVINGSTON PARISH, LOUISIANA

DATE  
AUGUST 2016

PROJECT NO  
20406.012.

SCALE  
AS SHOWN

SOURCE: BING MAPS AERIAL HYBRID  
NRC: 1156749, 1156486





## LEGEND

● SITE LOCATION



0 400 800

SCALE IN FEET



US EPA REGION 6

## FIGURE 2-2 SITE AREA MAP

LARD OIL COMPANY OIL SPILL  
914 FLORIDA AVE SW  
DENHAM SPRINGS, LIVINGSTON PARISH, LOUISIANA

SOURCE: BING MAPS AERIAL HYBRID  
NRC: 1156749, 1156486

DATE  
AUGUST 2016

PROJECT NO  
20406.012.

SCALE  
AS SHOWN

**ATTACHMENT A**  
**DATA QUALITY OBJECTIVES**

**Data Quality Objective #1 – Soil, Sediment, Vegetation Sampling**  
**Oil Identification/Presence**  
**Lard Oil Company Oil Spill Site**

<b>STEP 1. STATE THE PROBLEM</b>	
Severe flooding resulted in an oil spill release from the Lard Oil Company that affected nearby residential homes and commercial businesses.	
Biased, grab, soil, sediment, and vegetation samples will be collected from nearby flood impacted areas for oil identification analysis to determine the extent of contamination.	
<b>STEP 2. IDENTIFY THE DECISION</b>	
Do flood-impacted soils, sediments, and vegetation, represented by a sample, contain oil as identified by the U.S. Coast Guard Marine Safety Laboratory.	
IDENTIFY THE ALTERNATIVE ACTIONS THAT MAY BE TAKEN BASED ON THE DECISIONS.	<ul style="list-style-type: none"> <li>▪ If oil is identified, the media represented by that sample will be considered contaminated and will require attention.</li> <li>▪ If oil is not identified, the media represented by that sample will not require attention.</li> </ul>
<b>STEP 3. IDENTIFY INPUTS TO THE DECISION</b>	
IDENTIFY THE INFORMATIONAL INPUTS NEEDED TO RESOLVE A DECISION.	<ul style="list-style-type: none"> <li>▪ Presence or absence of oil in multi-media samples collected from nearby flood-impacted locations.</li> </ul>
IDENTIFY THE SOURCES FOR EACH INFORMATIONAL INPUT AND LIST THE INPUTS THAT ARE OBTAINED THROUGH ENVIRONMENTAL MEASUREMENTS.	<ul style="list-style-type: none"> <li>▪ Soil, sediment, vegetation samples collected from most likely affected downstream flood locations.</li> <li>▪ Oil Identification Analysis – U.S. Coast Guard Marine Safety Laboratory</li> </ul>
BASIS FOR THE CONTAMINANT SPECIFIC ACTION LEVELS.	<ul style="list-style-type: none"> <li>▪ Clean Water Act (CWA), 33 U.S.C. § 1321, ET SEQ, as amended by the Oil Pollution Act of 1990 (OPA 90).</li> <li>▪ Oil Identification Analysis – U.S. Coast Guard Marine Safety Laboratory</li> </ul>
IDENTIFY POTENTIAL SAMPLING TECHNIQUES AND APPROPRIATE ANALYTICAL METHODS.	<ul style="list-style-type: none"> <li>▪ Soil sampling techniques are described in Section 3.2.1 of the QASP</li> <li>▪</li> </ul>
<b>STEP 4. DEFINE THE BOUNDARIES OF THE STUDY</b>	
DEFINE THE DOMAIN OR GEOGRAPHIC AREA WITHIN WHICH ALL DECISIONS MUST APPLY.	Residential and commercial properties that appear to have been affected by the Lard Oil Company oil spill.
SPECIFY THE CHARACTERISTICS THAT DEFINE THE POPULATION OF INTEREST.	.Presence or absence of oil in multi-media.
DEFINE THE SCALE OF DECISION MAKING.	The scale of decision will be for soil, sediment or vegetation represented by each sample collected from the site or flood-impacted area of concern
DETERMINE THE TIME FRAME TO WHICH THE DATA APPLY.	The data will apply until the media represented by the sample receives appropriate response actions.

DETERMINE WHEN TO COLLECT DATA.	Samples will be collected as soon as possible to determine timely remedial actions, if any, for site closeout.
IDENTIFY PRACTICAL CONSTRAINTS ON DATA COLLECTION.	<ul style="list-style-type: none"> <li>▪ Inclement weather.</li> <li>▪ Access not attainable.</li> </ul>

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**Data Quality Objective #1 – Soil, Sediment, Vegetation Sampling  
Oil Identification/Presence  
Lard Oil Company Oil Spill Site**

<b>STEP 5. DEVELOP A DECISION RULE</b>	
SPECIFY THE PARAMETER THAT CHARACTERIZES THE POPULATION OF INTEREST.	<ul style="list-style-type: none"> <li>Presence or absence of oil as identified by Oil Identification Analysis – U.S. Coast Guard Marine Safety Laboratory</li> </ul>
SPECIFY THE ACTION LEVEL FOR THE DECISION.	Identification of oil in a sample.
DEVELOP A DECISION RULE.	If any sample is identified as containing oil, then the media represented by that sample will require attention; otherwise, the media does not require attention.
<b>STEP 6. SPECIFY LIMITS ON DECISION ERRORS</b>	
DETERMINE THE POSSIBLE RANGE OF THE PARAMETER OF INTEREST.	The range is qualitative – presence or absence of oil.
DEFINE BOTH TYPES OF DECISION ERRORS AND IDENTIFY THE POTENTIAL CONSEQUENCES OF EACH.	<p><u>Type I Error:</u> Deciding that the specified area represented by a sample does not contain oil when, in truth, the sample contains oil. The consequence of this decision error is that contaminated media will remain on-site, possibly endangering human health and the environment. There may also be potential future liability associated with clean-up costs of leaving contaminated soil on-site. This decision error is more severe.</p> <p><u>Type II Error:</u> Deciding that the specified area represented by a sample does contain oil when, in truth, it does not. The consequences of this decision error are that remediation of the specified area will proceed and unnecessary costs will be incurred.</p>
ESTABLISH THE TRUE STATE OF NATURE FOR EACH DECISION RULE.	<p>The true state of nature when the media is decided to contain oil when in fact it does not, is that the area may need remedial action.</p> <p>The true state of nature when the media is decided to not contain oil when in fact it does, is that the area may not need remedial action.</p>
DEFINE THE TRUE STATE OF NATURE FOR THE MORE SEVERE DECISION ERROR AS THE BASELINE CONDITION OR THE NULL HYPOTHESIS ( $H_0$ ) AND DEFINE THE TRUE STATE FOR THE LESS SEVERE DECISION ERROR AS THE ALTERNATIVE HYPOTHESIS ( $H_a$ ).	<p><math>H_0</math>: The media represented by a sample of the specified area does not contain oil.</p> <p><math>H_a</math>: The media represented by a sample of the specified area contains oil.</p>

**Data Quality Objective #1 – Soil, Sediment, Vegetation Sampling  
Oil Identification/Presence  
Lard Oil Company Oil Spill Site**

ASSIGN THE TERMS “FALSE POSITIVE” AND “FALSE NEGATIVE” TO THE PROPER DECISION ERRORS.	<ul style="list-style-type: none"> <li>▪ False Positive Error = Type I</li> <li>▪ False Negative Error = Type II</li> </ul>
ASSIGN PROBABILITY VALUES TO POINTS ABOVE AND BELOW THE ACTION LEVEL THAT REFLECT THE ACCEPTABLE PROBABILITY FOR THE OCCURRENCES OF DECISION ERRORS.	To be assigned based on discussions with EPA OSC.
<b>STEP 7. OPTIMIZE THE DESIGN</b>	
REVIEW THE DQOs	An optimal and sufficient number of samples, as determined by the EPA team, will be collected to determine the extent of contamination.
DEVELOP GENERAL SAMPLING AND ANALYSIS DESIGN. It is estimated that approximately 15 to 20 multi-media samples will be collected from nearby flood- impacted residential and commercial properties downstream from the Lard Oil facility. The samples collected will be used to determine if additional activities are warranted. The samples will be analyzed for oil identification analysis by U.S. Coast Guard Marine Safety Laboratory .	

**Data Quality Objective #2 – Soil, Sediment, Vegetation, Spill-Source Oil Liquids Sampling  
Comparative Oil Fingerprint Analysis  
Lard Oil Company Oil Spill Site**

<b>STEP 1. STATE THE PROBLEM</b>	
Severe flooding resulted in an oil spill release from the Lard Oil Company that affected nearby residential homes and commercial businesses.	
Biased, grab, soil, sediment, and vegetation samples will be collected from nearby flood-impacted areas for comparative oil fingerprint analysis to compare results from multi-media (soil, sediment and vegetation) samples and Spill-source oil liquids and other samples collected from the Lard Oil facility.	
<b>STEP 2. IDENTIFY THE DECISION</b>	
Do the fingerprint analysis of oil-containing source samples collected from the Lard Oil facility and from multi-media samples collected from nearby flooded-impacted (downstream) locations match as determined by the U.S. Coast Guard Marine Safety Laboratory.	
IDENTIFY THE ALTERNATIVE ACTIONS THAT MAY BE TAKEN BASED ON THE DECISIONS.	<ul style="list-style-type: none"> <li>▪ If a match is identified, the media represented by that sample will be considered contaminated by Lard Oil facility oil.</li> <li>▪ If a match is not identified, the EPA team will consider other possible sources for the contaminated media.</li> </ul>
<b>STEP 3. IDENTIFY INPUTS TO THE DECISION</b>	
IDENTIFY THE INFORMATIONAL INPUTS NEEDED TO RESOLVE A DECISION.	<ul style="list-style-type: none"> <li>▪ Match of oil fingerprints in multi-media samples collected from downstream locations and from the Lard Oil facility.</li> </ul>
IDENTIFY THE SOURCES FOR EACH INFORMATIONAL INPUT AND LIST THE INPUTS THAT ARE OBTAINED THROUGH ENVIRONMENTAL MEASUREMENTS.	<ul style="list-style-type: none"> <li>▪ Multi-media samples collected from most likely affected downstream locations and from the Lard Oil facility.</li> <li>▪ Comparative Oil Fingerprint Analysis by the U.S. Coast Guard Marine Safety Laboratory</li> </ul>
BASIS FOR THE CONTAMINANT SPECIFIC ACTION LEVELS.	<ul style="list-style-type: none"> <li>▪ Clean Water Act (CWA), 33 U.S.C. § 1321, ET SEQ, as amended by the Oil Pollution Act of 1990 (OPA 90).</li> <li>▪ Comparative Oil Fingerprint Analysis – U.S. Coast Guard Marine Safety Laboratory</li> </ul>
IDENTIFY POTENTIAL SAMPLING TECHNIQUES AND APPROPRIATE ANALYTICAL METHODS.	<ul style="list-style-type: none"> <li>▪ Soil sampling techniques are described in Section 3.2.1 of the QASP</li> <li>▪ Comparative Oil Fingerprint Analysis – U.S. Coast Guard Marine Safety Laboratory</li> </ul>
<b>STEP 4. DEFINE THE BOUNDARIES OF THE STUDY</b>	
DEFINE THE DOMAIN OR GEOGRAPHIC AREA WITHIN WHICH ALL DECISIONS MUST APPLY.	The Lard Oil facility and residential and commercial properties that appear to have been affected by the Lard Oil Company oil spill.
SPECIFY THE CHARACTERISTICS THAT DEFINE THE POPULATION OF INTEREST.	Match of oil fingerprints in multi-media samples taken from the spill source and downstream areas.

DEFINE THE SCALE OF DECISION MAKING.	The scale of decision will be for soil, sediment or vegetation represented by each sample collected from the site or flood impacted area of concern.
DETERMINE THE TIME FRAME TO WHICH THE DATA APPLY.	The data will apply until the media represented by the sample receives appropriate response actions.
DETERMINE WHEN TO COLLECT DATA.	Samples will be collected as soon as possible to determine timely remedial actions, if any, for site closeout.
IDENTIFY PRACTICAL CONSTRAINTS ON DATA COLLECTION.	<ul style="list-style-type: none"> <li>▪ Inclement weather.</li> <li>▪ Access not attainable.</li> </ul>

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**Data Quality Objective #2 – Soil, Sediment, Vegetation, Spill-Source Oil Liquids Sampling  
Comparative Oil Fingerprint Analysis  
Lard Oil Company Oil Spill Site**

<b>STEP 5. DEVELOP A DECISION RULE</b>	
SPECIFY THE PARAMETER THAT CHARACTERIZES THE POPULATION OF INTEREST.	Oil fingerprint match or no match as identified by Comparative Oil Fingerprint Analysis – U.S. Coast Guard Marine Safety Laboratory.
SPECIFY THE ACTION LEVEL FOR THE DECISION.	Identification of a fingerprint match.
DEVELOP A DECISION RULE.	If any downstream sample is identified as containing a matching oil fingerprint with a Lard Oil facility sample, then the media represented by that sample will be determined to have been contaminated by the Lard Oil facility; otherwise, other sources for contamination will be considered.
<b>STEP 6. SPECIFY LIMITS ON DECISION ERRORS</b>	
DETERMINE THE POSSIBLE RANGE OF THE PARAMETER OF INTEREST.	The range is qualitative – presence or absence of a fingerprint match.
DEFINE BOTH TYPES OF DECISION ERRORS AND IDENTIFY THE POTENTIAL CONSEQUENCES OF EACH.	<p><b>Type I Error:</b> Deciding that a downstream sample does not match a Lard Oil facility sample when, in truth, the sample matches. The consequence of this decision error is that resources will be expended to consider other possible sources of the oil spill unnecessarily.</p> <p><b>Type II Error:</b> Deciding that a downstream sample matches a Lard Oil facility sample when, in truth, it does not. The consequences of this decision error are that other sources for the oil spill will not be considered. There may also be potential future liability associated with mis-identifying an RP. This decision error is more severe.</p>
ESTABLISH THE TRUE STATE OF NATURE FOR EACH DECISION RULE.	<p>The true state of nature when a downstream sample is decided to match a Lard Oil facility sample when in fact it does not, is that other potential responsible parties will not be identified.</p> <p>The true state of nature when a downstream sample is decided to not match a Lard Oil facility sample when in fact it does, is that resources will be expended to consider other possible sources of oil unnecessarily.</p>
DEFINE THE TRUE STATE OF NATURE FOR THE MORE SEVERE DECISION ERROR AS THE BASELINE CONDITION OR THE NULL HYPOTHESIS ( $H_0$ ) AND DEFINE THE TRUE STATE FOR THE LESS SEVERE DECISION ERROR AS THE ALTERNATIVE HYPOTHESIS ( $H_a$ ).	<p><math>H_0</math>: A downstream sample oil fingerprint does not match a Lard Oil facility sample oil fingerprint.</p> <p><math>H_a</math>: A downstream sample oil fingerprint matches a Lard Oil facility sample oil fingerprint.</p>

**Data Quality Objective #2 – Soil, Sediment, Vegetation, Spill-Source Oil Liquids Sampling  
Comparative Oil Fingerprint Analysis  
Lard Oil Company Oil Spill Site**

ASSIGN THE TERMS “FALSE POSITIVE” AND “FALSE NEGATIVE” TO THE PROPER DECISION ERRORS.	<ul style="list-style-type: none"> <li>False Positive Error = Type I</li> <li>False Negative Error = Type II</li> </ul>
ASSIGN PROBABILITY VALUES TO POINTS ABOVE AND BELOW THE ACTION LEVEL THAT REFLECT THE ACCEPTABLE PROBABILITY FOR THE OCCURRENCES OF DECISION ERRORS.	To be assigned based on discussions with EPA OSC.
<b>STEP 7. OPTIMIZE THE DESIGN</b>	
REVIEW THE DQOs	An optimal and sufficient number of Lard Oil facility and downstream samples, as determined by the EPA team, will be collected to compare oil fingerprints.
DEVELOP GENERAL SAMPLING AND ANALYSIS DESIGN.  It is estimated that approximately 15 to 20 samples will be collected from nearby flood- impacted residential and commercial properties downstream from the Lard Oil facility. It is estimated that approximately 5 to 10 samples will be collected from the Lard Oil facility. The samples collected will be used to determine if additional activities are warranted. The samples will be analyzed for comparative oil fingerprint analysis by the U.S. Coast Guard Marine Safety Laboratory.	

**Data Quality Objective #3 – Indoor Residential/Commercial Building Materials Wipe Sampling**  
**Lard Oil Company Oil Spill Site**

<b>STEP 1. STATE THE PROBLEM</b>	
<p>Severe flooding resulted in an oil spill release from the Lard Oil Company that affected nearby residential homes and commercial businesses. The objective is to determine if the nearby flood impacted homes and commercial businesses contain oil spill contamination as indicated by analytical results for total petroleum hydrocarbon (TPH) diesel range organics (DRO) and oil range organics (ORO) of wipe samples.</p> <p>The Responsible Party (RP) will collect indoor wipe samples from nearby residential/commercial building materials impacted by the flood. Wipe samples will be analyzed for TPH s (DRO &amp; ORO) constituents. The EPA Team will collect confirmation wipe samples from the same residential homes and commercial businesses to ensure data reliability and quality assurance.</p>	
<b>STEP 2. IDENTIFY THE DECISION</b>	
Are RP indoor wipe sample results consistent with analytical results from EPA's split samples and are the data results above specified action levels?	
IDENTIFY THE ALTERNATIVE ACTIONS THAT MAY BE TAKEN BASED ON THE DECISIONS.	<ul style="list-style-type: none"> <li>If wipe sample results do not exceed action levels for the contaminants of concern (COCs) and the RP wipe sample results are reproducible (confirmed by EPA samples), no additional site remediation activities will be required.</li> <li>If wipe sample results exceed action levels for the contaminants of concern (COCs) and/or the RP wipe sample results are not reproducible (not confirmed by EPA samples), additional site assessment and remediation options will be discussed with the EPA On-Scene Coordinator.</li> </ul>
<b>STEP 3. IDENTIFY INPUTS TO THE DECISION</b>	
IDENTIFY THE INFORMATIONAL INPUTS NEEDED TO RESOLVE A DECISION.	<ul style="list-style-type: none"> <li>TPH concentrations found in wipe samples collected in residential homes and commercial businesses.</li> <li>TPH concentrations reported in RP samples compared to EPA samples.</li> </ul>
IDENTIFY THE SOURCES FOR EACH INFORMATIONAL INPUT AND LIST THE INPUTS THAT ARE OBTAINED THROUGH ENVIRONMENTAL MEASUREMENTS.	<ul style="list-style-type: none"> <li>Indoor wipe samples collected from most likely flood-affected downstream locations.</li> <li>Total Petroleum Hydrocarbons – Diesel Range Organics (DRO) and Oil Range Organics (ORO) analysis (EPA Method 8015).</li> </ul>
BASIS FOR THE CONTAMINANT SPECIFIC ACTION LEVELS.	<ul style="list-style-type: none"> <li>Louisiana Department of Environmental Quality (LDEQ), Risk Evaluation/Corrective Action Program (RECAP), October, 2003.</li> </ul>
IDENTIFY POTENTIAL SAMPLING TECHNIQUES AND APPROPRIATE ANALYTICAL METHODS.	<ul style="list-style-type: none"> <li>Soil sampling techniques are described in Section 3.2.2 of the QASP</li> <li>EPA SW-846 Method 8015</li> </ul>
<b>STEP 4. DEFINE THE BOUNDARIES OF THE STUDY</b>	

**Commented [WJ1]:** Need to confirm with OSC. Note – RECAP values are for soil and GW.

DEFINE THE DOMAIN OR GEOGRAPHIC AREA WITHIN WHICH ALL DECISIONS MUST APPLY.	The residential and commercial properties that appear to have been affected by the Lard Oil Company oil spill.
SPECIFY THE CHARACTERISTICS THAT DEFINE THE POPULATION OF INTEREST.	Concentrations of TPH (DRO, ORO) constituents in indoor wipe samples.
DEFINE THE SCALE OF DECISION MAKING.	The scale of decision will be for residential and commercial properties represented by each wipe sample collected from the site.
DETERMINE THE TIME FRAME TO WHICH THE DATA APPLY.	The data will apply until the media represented by the sample receives appropriate response actions.
DETERMINE WHEN TO COLLECT DATA.	Samples will be collected as soon as possible to determine timely remedial actions, if any, for site closeout.
IDENTIFY PRACTICAL CONSTRAINTS ON DATA COLLECTION.	<ul style="list-style-type: none"> <li>▪ Inclement weather.</li> <li>▪ Access not attainable.</li> </ul>

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**Data Quality Objective #3 – Indoor Housing Residential/Commercial Building Materials  
Wipe Sampling  
Lard Oil Company Oil Spill Site**

<b>STEP 5. DEVELOP A DECISION RULE</b>	
SPECIFY THE PARAMETER THAT CHARACTERIZES THE POPULATION OF INTEREST.	Concentrations of TPH-DRO,ORO constituents in indoor wipe samples.
SPECIFY THE ACTION LEVEL FOR THE DECISION.	<ul style="list-style-type: none"> <li>▪ Louisiana Department of Environmental Quality (LDEQ), Risk Evaluation/Corrective Action Program (RECAP), October, 2003.</li> <li>▪ The EPA OSC will determine a quantitative range to determine reproducibility of RP results</li> </ul>
DEVELOP A DECISION RULE.	If any result in a wipe sample is above a site specific action level or the RP wipe sample results are not confirmed by EPA sample data , additional actions will need to be discussed with the OSC.
<b>STEP 6. SPECIFY LIMITS ON DECISION ERRORS</b>	
DETERMINE THE POSSIBLE RANGE OF THE PARAMETER OF INTEREST.	Contaminant concentrations may range from 0 milligrams per kilograms (mg/kg) to more than the LDEQ RECAP level for that contaminant.
DEFINE BOTH TYPES OF DECISION ERRORS AND IDENTIFY THE POTENTIAL CONSEQUENCES OF EACH.	<p><u>Type I Error:</u> Deciding that the specified area represented by the wipe sample does not exceed the specified action level or deciding that an RP sample result was reproducible when, in truth, the wipe sample concentration of the contaminant exceeds its specified action level and/or the the sample results were not reproducible. The consequence of this decision error is that contaminated material may remain on-site, possibly endangering human health and the environment. There may also be potential future liability associated with cleanup costs of leaving contaminated soil on-site. This decision error is more severe.</p> <p><u>Type II Error:</u> Deciding that the specified area represented by the wipe sample does exceed the specified action level or deciding that an RP sample result was not reproducible when, in truth, the wipe sample concentration of the contaminant did not exceed its specified action level and/or the sample results were reproducible. The consequences of this decision error are that additional site actives or remediation of the specified area will continue and unnecessary costs will be incurred.</p>

<p>ESTABLISH THE TRUE STATE OF NATURE FOR EACH DECISION RULE.</p>	<p>The true state of nature when a wipe sample result exceeded specified action levels or an RP sample result was not reproducible when, in truth, the sample result did not exceed a specified action level and the RP samples results were reproducible is that resources will be expended unnecessarily to resample previously sampled areas.</p> <p>The true state of nature when a wipe sample result did not exceed specified action levels and or RP sample results were reproducible when, in truth, the sample result did exceed specified action levels and or the RP results were not reproducible is that remediation or no action of the specified area will not proceed in areas that may need additional site activities.</p>
<p>DEFINE THE TRUE STATE OF NATURE FOR THE MORE SEVERE DECISION ERROR AS THE BASELINE CONDITION OR THE NULL HYPOTHESIS (<math>H_0</math>) AND DEFINE THE TRUE STATE FOR THE LESS SEVERE DECISION ERROR AS THE ALTERNATIVE HYPOTHESIS (<math>H_a</math>).</p>	<p><math>H_0</math>: An indoor wipe sample result exceed specified action levels or the RP data was not reproducible when split sampled by the EPA.</p> <p><math>H_a</math>: An indoor wipe sample result does not exceed specified action levels and the RP data is reproducible when split sampled by the EPA.</p>

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**Data Quality Objective #3 – Indoor Housing Residential/Commercial Building  
Materials Wipe Sampling  
Lard Oil Company Oil Spill Site**

ASSIGN THE TERMS “FALSE POSITIVE” AND “FALSE NEGATIVE” TO THE PROPER DECISION ERRORS.	<ul style="list-style-type: none"> <li>False Positive Error = Type I</li> <li>False Negative Error = Type II</li> </ul>
ASSIGN PROBABILITY VALUES TO POINTS ABOVE AND BELOW THE ACTION LEVEL THAT REFLECT THE ACCEPTABLE PROBABILITY FOR THE OCCURRENCES OF DECISION ERRORS.	To be assigned based on discussions with EPA OSC.
<b>STEP 7. OPTIMIZE THE DESIGN</b>	
REVIEW THE DQOs	An optimal and sufficient number of samples, as determined by the EPA team, will be split with the RP to ensure the quality assurance of RP sampling activities.
DEVELOP GENERAL SAMPLING AND ANALYSIS DESIGN.  The EPA team will collect approximately 5 to 10 split indoor wipe samples from nearby residential and commercial properties impacted by the flood and the Lard Oil facility. Sample location will be determined by field observations and in concurrence with the EPA OSC. The wipe sample data will be utilized to ensure data reliability of RP sample results and overall quality assurance. The samples will be analyzed for Total Petroleum Hydrocarbons – DRO and ORO via EPA SW-846 Method 8015. Sample results will be used to determine if additional activities are warranted.	

**Attachment B**  
**Standard Operating Procedures**

<b>SOP</b>	<b>1001.01</b>				
<b>GROUP</b>	Sampling Procedures				
<b>SUB-GROUP</b>	Soil Sampling Procedures				
<b>TITLE</b>	Surface Soil Sampling				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1001-01.DOC	<b>PAGE</b>	1 of 3

## INTRODUCTION

The following Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment. This SOP is similar to SOP Number 1001.03 for collecting near surface soil samples with a hand auger.

## PROCEDURE

Surface soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, or hand scoop.

### Sample Preservation

Cooling to  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , supplemented by a minimal holding time, is suggested.

### Interferences and Potential Problems

There are two primary interferences or potential problems associated with soil sampling: cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated (disposable) sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results. Homogenization may also affect sample representativeness where the analytical requirements include volatile organic compounds.

### Equipment or Apparatus

The equipment used for sampling may be selected from the following list, as appropriate:

- Tape measure
- Survey stakes or flags
- Stainless steel, plastic, or other appropriate homogenization bucket or bowl
- Ziploc plastic bags
- Logbook
- Labels
- Chain-of-custody forms and seals
- Coolers
- Ice
- Decontamination supplies and equipment
- Canvas or plastic sheet
- Spatulas/spades/shovels
- Scoops

<b>SOP</b>	<b>1001.01</b>				
<b>GROUP</b>	Sampling Procedures				
<b>SUB-GROUP</b>	Soil Sampling Procedures				
<b>TITLE</b>	Surface Soil Sampling				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1001-01.DOC	<b>PAGE</b>	2 of 3

- Plastic or stainless steel spoons
- Trowel

### Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and what equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment from the list above.
3. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
4. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
5. Decontaminate or preclean equipment, and ensure that it is in working order.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner or other responsible party prior to soil sampling.
7. Evaluate safety concerns associated with sampling that may require use of personal protective equipment and/or air monitoring.

### Surface Soil Sample Collection

Collect samples from the near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Avoid the use of devices plated with chrome or other target analyte materials.

The following procedures should be followed when collecting surface soil samples:

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or if composite samples are to be collected, place a sample from another sampling interval into the

<b>SOP</b>	<b>1001.01</b>				
<b>GROUP</b>	Sampling Procedures				
<b>SUB-GROUP</b>	Soil Sampling Procedures				
<b>TITLE</b>	Surface Soil Sampling				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1001-01.DOC	<b>PAGE</b>	3 of 3

homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

4. Fill hole created through sampling with unused material or other appropriate backfill material (sand).
5. Record applicable information into field log book or appropriate forms as documentation of sampling.

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<b>SOP</b>	<b>1002.04</b>				
<b>GROUP</b>	Sampling Procedures				
<b>SUB-GROUP</b>	Soil Sampling Procedures				
<b>TITLE</b>	Sediment Sampling				
<b>DATE</b>	3/12/2010	<b>FILE</b>	1002-04.DOC	<b>PAGE</b>	1 of 3

## INTRODUCTION

The following Standard Operating Procedure (SOP) is to describe the procedures for collecting representative sediment samples using a trowel, piston corer, WILDCO KB Core Sampler, a Ponar Grab Sampler, or other similar equipment. Analysis of sediment samples may be performed to determine whether concentrations of specific sediment pollutants exceed established action levels, or if the concentrations of sediment pollutants present a risk to public health, welfare, or the environment.

## PROCEDURE

### Overview

Sediment samples may be collected using trowels, core and Ponar sampler, or a variety of similar methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of sediment (fines versus coarse). Sampling in shallow areas or streams near the surface may only require a hand trowel, while sampling at depth may be performed using a core or Ponar sampler.

### Sample Preservation

Refrigeration to  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , supplemented by a minimal holding time, is suggested.

### Interferences and Potential Problems

There are two primary interferences or potential problems associated with sediment sampling: cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated (disposable) sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in mixing of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results. Homogenization may also affect sample representativeness when the analytical requirements include volatile organic compounds.

### Equipment or Apparatus

The equipment selected for the sampling effort may include the following as appropriate:

- Tape measure
- Survey stakes or flags
- Stainless steel, plastic, or other appropriate homogenization bucket or bowl
- Ziploc plastic bags
- Logbook
- Labels
- Chain-of-custody forms and seals
- Coolers
- Ice



<b>SOP</b>	<b>1002.04</b>				
<b>GROUP</b>	Sampling Procedures				
<b>SUB-GROUP</b>	Soil Sampling Procedures				
<b>TITLE</b>	Sediment Sampling				
<b>DATE</b>	3/12/2010	<b>FILE</b>	1002-04.DOC	<b>PAGE</b>	2 of 3

- Decontamination supplies and equipment (i.e. brushes and buckets)
- Canvas or plastic sheeting
- Spatulas
- Scoops
- Plastic or stainless steel spoons
- Trowel
- Auger bucket
- Extension rods
- T-handle
- KB Core Sampler
- Ponar Grab Sampler
- Air monitor

#### Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment from the list above. Additional equipment may be added to this list as appropriate to perform other sampling.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
5. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and obstructions.

#### Sediment Sampling in Shallow Waters

The following procedures should be used when collecting sediment samples in shallow waters:

1. Collect sediments as specified in the work plan or as determined during office preparation activities, using a stainless steel trowel, piston corer or similar device and a stainless steel, tempered glass or aluminum container.
2. Standing downstream of the sample stations, collect discrete sediment samples from each station and, if required in the work plan, composite in stainless steel, tempered glass or aluminum container.
3. Collect sediment samples of deposited material from the depth specified in the work plan or as determined during the office preparation activities. Record the depth in the logbook. Selective removal of the top sediment layers may be required and should be accomplished by carefully removing the sediments with a stainless steel trowel or scoop. In streams where water velocity is insufficient to disturb sediment fines during sediment sampling, a stainless

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<b>GROUP</b>	Sampling Procedures				
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steel trowel or scoop may be used for sampling. Where water velocities are high, a stainless steel corer will be utilized.

4. When applicable, composite discrete sediment samples by placing equal volumes of sediment material collected from the sample points into the container and mixing thoroughly to obtain a homogeneous mixture. Samples may be sieved or hand picked, if necessary, to remove larger materials, such as leaves, sticks, gravel, or rocks. Record in the logbook the nature of any materials removed from the sediment samples.
5. Place each sediment sample into the proper clean, unused sample container, as required by the work plan or laboratory. Sampling personnel must avoid placing sediment into the sample container and decanting off the excess liquid in analyzing for volatile organics and water soluble compounds in the sediment and reduces accurate representation of sediment analysis.
6. Fill out labels with waterproof ink and attach to the sample container.
7. Decontaminate sampling equipment between samples.

#### Sediment Sampling in Deep Waters

Procedures for sampling in deep waters are the same as for shallow waters except the sampling equipment is different. Soft, fine-grained sediments collected in deep waters will be sampled with a WILDCO KB Core Sampler or similar equipment. Coarse-grained sediments will be collected utilizing a Ponar Grab Sampler or similar equipment. Both samplers will be operated from a boat following appropriate safety procedures. Documentation, containerization, labeling and decontamination procedures are the same as for sediment samples collected in shallow waters.

#### Sediment Sampling in Drainage Ditches and Intermittent Streams

Procedures for sediment sampling in drainage ditches and the dry portions of intermittent streams are as specified for shallow water sediments.



# CHIP, WIPE, AND SWEEP SAMPLING

SOP#: 2011  
DATE: 11/16/94  
REV. #: 0.0

## 1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potential surficial contamination.

This method of sampling is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., PCB, PCDD, PCDF, metals, cyanide, etc.) Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is one square foot. However, based upon sampling location, the sample size may need modification due to area configuration.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

## 2.0 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean, autoclaved aluminum foil until ready for use. To

collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. While wearing a new pair of surgical gloves, a sterile gauze pad is opened, and soaked with solvent. The solvent used is dependent on the surface being sampled. This pad is then stroked firmly over the sample surface, first vertically, then horizontally, to ensure complete coverage. The pad is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable surgical gloves, a dedicated brush is used to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are then sent to the laboratory for analysis.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples should be stored out of direct sunlight to reduce photodegradation, cooled to 4°C and shipped to the laboratory performing the analysis. Appropriately sized laboratory cleaned, glass sample jars should be used for sample collection. The amount of sample required will be determined in concert with the analytical laboratory.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough porous

surfaces which may be difficult to wipe, chip, or sweep.

## 5.0 EQUIPMENT

Equipment required for performing chip, wipe, or sweep sampling is as follows:

- C Lab clean sample containers of proper size and composition
- C Site logbook
- C Sample analysis request forms
- C Chain of Custody records
- C Custody seals
- C Field data sheets
- C Sample labels
- C Disposable surgical gloves
- C Sterile wrapped gauze pad (3 in. x 3 in.)
- C Appropriate pesticide (HPLC) grade solvent
- C Medium sized laboratory cleaned paint brush
- C Medium sized laboratory cleaned chisel
- C Autoclaved aluminum foil
- C Camera
- C Hexane (pesticide/HPLC grade)
- C Iso-octane
- C Distilled/deionized water

## 6.0 REAGENTS

Reagents are not required for preservation of chip, wipe or sweep samples. However, reagents will be utilized for decontamination of sampling equipment.

## 7.0 PROCEDURES

### 7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific

Health and Safety Plan.

6. Mark all sampling locations. If required the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

### 7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per the Sampling Equipment Decontamination SOP. It is then wrapped in cleaned, autoclaved aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampling device should be used for only one sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.
2. Record surface area to be chipped.
3. Don a new pair of disposable surgical gloves.
4. Open a laboratory-cleaned chisel or equivalent sampling device.
5. Chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.
6. Place the sample in an appropriately prepared sample container with a Teflon lined cap.
7. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.
8. Store samples out of direct sunlight and cool to 4EC.
9. Follow proper decontamination procedures then deliver sample(s) to the laboratory for analysis.

### 7.3 Wipe Sample Collection

Wipe sampling is accomplished by using a sterile

gauze pad, adding a solvent in which the contaminant is most soluble, then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each gauze pad is used for only one wipe sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.
2. Record surface area to be wiped.
3. Don a new pair of disposable surgical gloves.
4. Open new sterile package of gauze pad.
5. Soak the pad with solvent of choice.
6. Wipe the marked surface area using firm strokes. Wipe vertically, then horizontally to insure complete surface coverage.
7. Place the gauze pad in an appropriately prepared sample container with a Teflon-lined cap.
8. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.
9. Store samples out of direct sunlight and cool to 4°C.
10. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

#### **7.4 Sweep Sample Collection**

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.
2. Record the surface area to be swept.

3. Don new pair of disposable surgical gloves.
4. Sweep the measured area using a dedicated brush; collect the sample in a dedicated dust pan.
5. Transfer sample from dust pan to sample container.
6. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site log book and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.
7. Store samples out of direct sunlight and cool to 4°C.
8. Leave contaminated sampling device in the sample material, unless decontamination is practical.
9. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

### **8.0 CALCULATIONS**

Results are usually provided in mg/g, µg/g, mass per unit area, or other appropriate measurement. Calculations are typically done by the laboratory.

### **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody forms, field data sheets or within the site logbook.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

The following specific quality assurance activities apply to wipe samples:

For wipe samples, a blank should be collected for each sampling event. This consists of a sterile gauze pad, wet with the appropriate solvent, and placed in a prepared sample container. The blank will help identify potential introduction of contaminants via the sampling methods, the pad, solvent or sample container. Spiked wipe samples can also be collected to better assess the data being generated. These are prepared by spiking a piece of foil of known area with a standard of the analyte of choice. The solvent containing the standard is allowed to evaporate, and the foil is wiped in a manner identical to the other wipe samples.

Specific quality assurance activities for chip and sweep samples should be determined on a site specific basis.

## **10.0 DATA VALIDATION**

A review of the quality control samples will be conducted and the data utilized to qualify the environmental results.

## **11.0 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow EPA, OSHA and corporate health and safety procedures.

## **12.0 REFERENCES**

U.S. EPA, A Compendium of Superfund Field Operation Methods. EPA/540/5-87/001.

NJDEP Field Sampling Procedures Manual, February, 1988.

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<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	<b>11/19/2001</b>	<b>FILE</b>	1101-01.DOC	<b>PAGE</b>	1 of 4

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents procedures for maintaining sample chain of custody (COC) during activities where samples are collected.

## PROCEDURE

Sample custody is defined as being under a person's custody if any of the following conditions exist:

- it is in their possession,
- it is in their view, after being in their possession,
- it was in their possession and they locked it up, or
- it is in a designated secure area.

A designated field sampler will be personally responsible for the care and custody of collected samples until they are transferred to another person or properly dispatched to the laboratory. To the extent practicable, as few people as possible will handle the samples.

Sample tags or labels will be completed and applied to the container of each sample. When the tags or labels are being completed, waterproof ink will be used. If waterproof ink is not used, the tags or labels will be covered by transparent waterproof tape. Sample containers may also be placed in Ziploc-type storage bags to help keep them clean in the cooler. Information typically included on the sample tags or labels will include the following:

- Project Code
- Station Number and Location
- Sample Identification Number
- Date and Time of Sample Collection
- Type of Laboratory Analysis Required
- Preservation Required, if applicable
- Collector's Signature
- Priority (optional)
- Other Remarks

Additional information may include:

- Anticipated Range of Results (Low, Medium, or High)
- Sample Analysis Priority

<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
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A COC form will be completed each time a sample or group of samples is prepared for transfer to the laboratory. The form will repeat the information on each of the sample labels and will serve as documentation of handling during shipment. The minimum information requirements of the COC form are listed in Table 1101.01-A. An example COC form is shown in Figure 1101.01-A. The completed COC must be reviewed by the Field Team Leader or Site Manager prior to sample shipment. The COC form will remain each sample shipping container at all times, and another copy will be retained by the member of the sampling team who originally relinquished the samples or in a project file.

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<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	<b>11/19/2001</b>	<b>FILE</b>	1101-01.DOC	<b>PAGE</b>	3 of 4

**TABLE 1101.01-A CHAIN OF CUSTODY FORM**

<b>INFORMATION</b>	<b>COMPLETED BY</b>	<b>DESCRIPTION</b>
<b>COC</b>	Laboratory	enter a unique number for each chain of custody form
<b>SHIP TO</b>	Field Team	enter the laboratory name and address
<b>CARRIER</b>	Field Team	enter the name of the transporter (e.g., FedEx) or handcarried
<b>AIRBILL</b>	Field Team	enter the airbill number or transporter tracking number (if applicable)
<b>PROJECT NAME</b>	Field Team	enter the project name
<b>SAMPLER NAME</b>	Field Team	enter the name of the person collecting the samples
<b>SAMPLER SIGNATURE</b>	Field Team	signature of the person collecting the samples
<b>SEND RESULTS TO</b>	Field Team	enter the name and address of the prime contractor
<b>FIELD SAMPLE ID</b>	Field Team	enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)
<b>DATE</b>	Field Team	enter the year and date the sample was collected in the format M/D (e.g., 6/3)
<b>TIME</b>	Field Team	enter the time the sample was collected in 24 hour format (e.g., 0900)
<b>MATRIX</b>	Field Team	enter the sample matrix (e.g., water, soil)
<b>PRESERVATIVE</b>	Field Team	enter the preservative used (e.g., HNO3) or "none"
<b>FILTERED/ UNFILTERED</b>	Field Team	enter "F" if the sample was filtered or "U" if the sample was not filtered
<b>CONTAINERS</b>	Field Team	enter the number of containers associated with the sample
<b>MS/MSD</b>	Field Team or Laboratory	enter "X" if the sample is designated for the MS/MSD
<b>ANALYSES REQUESTED</b>	Field Team	enter the method name of the analysis requested (e.g., SW6010A)
<b>COMMENTS</b>	Field Team	enter comments
<b>SAMPLE CONDITION UPON RECEIPT AT LABORATORY</b>	Laboratory	enter any problems with the condition of any sample(s)
<b>COOLER TEMPERATURE</b>	Laboratory	enter the internal temperature of the cooler, in degrees C, upon opening
<b>SPECIAL INSTRUCTIONS/COMMENTS</b>	Laboratory	enter any special instructions or comments
<b>RELEASED BY (SIG)</b>	Field Team and Laboratory	enter the signature of the person releasing custody of the samples
<b>COMPANY NAME</b>	Field Team and Laboratory	enter the company name employing the person releasing/receiving custody
<b>RECEIVED BY (SIG)</b>	Field Team and Laboratory	enter the signature of the person receiving custody of the samples
<b>DATE</b>	Field Team and Laboratory	enter the date in the format M/D/YY (e.g., 6/3/96) when the samples were released/received
<b>TIME</b>	Field Team and Laboratory	enter the date in 24 hour format (e.g., 0900) when the samples were released/received

<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	<b>11/19/2001</b>	<b>FILE</b>	1101-01.DOC	<b>PAGE</b>	4 of 4

**FIGURE 1101.01-A CHAIN OF CUSTODY FORM**

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<b>SOP</b>	<b>1102.01</b>				
<b>GROUP</b>	Sample Handling				
<b>SUB-GROUP</b>	Sample Shipping				
<b>TITLE</b>	Sample Shipping				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1102-01.DOC	<b>PAGE</b>	1 of 1

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the procedures for sample shipping that will be implemented during field work involving sampling activities.

## TERMS

COC - Chain-of-Custody

## PROCEDURE

Prior to shipping or transferring custody of samples, they will be packed according to D.O.T. requirements with sufficient ice to maintain an internal temperature of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  during transport to the laboratory. Samples relinquished to the participating laboratories will be subject to the following procedures for transfer of custody and shipment:

1. Samples will be accompanied by a COC record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. If sent by common carrier, a bill of lading or airbill should be used. Bill of lading and airbill receipts will be retained in the project file as part of the permanent documentation of sample shipping and transfer. This custody record documents transfer of sample custody from the sampler to another person or to the laboratory. The designated laboratory will accept custody in the field upon sample pick-up or at the laboratory if the samples are delivered via field personnel or a courier service.
2. Samples will be properly packed in approved shipping containers for laboratory pick-up by the appropriate laboratory for analysis, with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be padlocked or custody-sealed for transfer to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be folded over and stuck to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal will then be signed. The designated laboratory will accept custody of the samples upon receipt.
3. Whenever samples are split with state representatives or other parties, the COC record will be marked to indicate with whom the samples were split.
4. The field sampler will call the designated laboratory to inform them of sample shipment and verify sample receipt as necessary.

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	1 of 3

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the methods used for minimizing the potential for cross-contamination, and provides general guidelines for sampling equipment decontamination procedures.

## PROCEDURE

As part of the Health and Safety Plan (HASP), develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The decontamination plan should include the following:

- The number, location, and layout of decontamination stations
- Which decontamination apparatus is needed
- The appropriate decontamination methods
- Methods for disposal of contaminated clothing, apparatus, and solutions

### Decontamination Methods

Personnel, samples, and equipment leaving the contaminated area of a site will be decontaminated. Various decontamination methods will be used to either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or both. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

#### *Abrasive Cleaning Methods*

Abrasive cleaning methods work by rubbing/scrubbing the surface containing the contaminant. This method includes mechanical and wet blasting methods.

Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.

Cleaning can also be accomplished by water blasting which is also referred to as steam cleaning and pressure washing. Pressure washing utilizes high-pressure that is sprayed from a nozzle onto sampling equipment to physically remove soil or (potentially) contaminated material. Steam cleaning is a modification of pressure washing where the water is heated to temperatures approaching 100°C to assist in removing organic constituents from equipment.

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	2 of 3

### *Disinfection/Rinse Methods*

Disinfectants are a practical means of inactivating chemicals or contaminants of concern. Standard sterilization methods involve heating the equipment which is impractical for large equipment. Rinsing removes contaminants through dilution, physical attraction, and solubilization.

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be target analyte free. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions. An untreated potable water supply is not an acceptable substitute for tap water. Acids and solvents are occasionally utilized in decontamination of equipment to remove metals and organics, respectively, from sampling equipment. Other than ethanol, these are avoided when possible due to the safety, disposal, and transportation concerns associated with them.

Equipment or apparatuses that may be selected for use include the following:

- Personal protective clothing
- Non-phosphate detergent
- Selected solvents for removal of polar and nonpolar organics (ethanol, methanol, hexane)
- Acid washes for removal of metals (nitric acid)
- Long-handled brushes
- Drop cloths or plastic sheeting
- Paper towels
- Galvanized tubs or buckets
- Distilled, deionized, or tap water (as required by the project)
- Storage containers for spent wash solutions
- Sprayers (pressurized and non-pressurized)
- Trash bags
- Safety glasses or splash shield

### Field Sampling Equipment Cleaning Procedures

The following procedures should be followed:

1. Where applicable, follow physical removal procedures previously described (pressure wash, scrub wash)
2. Wash equipment with a non-phosphate detergent solution
3. Rinse with tap water
4. Rinse with distilled or deionized water
5. Rinse with 10% nitric acid if the sample will be analyzed for metals/organics
6. Rinse with distilled or deionized water
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics
8. Air dry the equipment completely
9. Rinse again with distilled or deionized water

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	11/19/2001	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	3 of 3

10. Place in clean bag or container for storage/transport to subsequent sampling locations.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if the analyses do not include inorganics. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, ethanol, hexane, methanol, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the ten-step decontamination procedure listed above may be modified for site specificity.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing before commencement of sampling and between sampling locations. Plastic tubing should not be reused.

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<b>SOP</b>	<b>0110.04</b>				
<b>GROUP</b>	Database Management System				
<b>SUB-GROUP</b>	Data Collection and Acquisition				
<b>TITLE</b>	On-Site Sample Nomenclature - On-Site Sampling Activities				
<b>DATE</b>	<b>07/04/2001</b>	<b>FILE</b>	0110-04.DOC	<b>PAGE</b>	1 of 1

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the remediation sample nomenclature for analytical samples. The sample nomenclature is based upon specific code requirements for compatibility with the WESTON On-Line system

## PROCEDURE

### Sampling Stations.

Station Type	Template
Soil Stockpile	SS##
Monitoring Well	MW##
Surface Water Pond	POND##
Air Sampler	AIR##

### Sample Nomenclature.

Sample Type	Template	Example
Soil Composite Sample	Stockpile - Type - QC - Sequence	SS01-CO-N-1
Surface Water Sample	Surface Water Pond-Type-QC-Sequence	POND03-CO-N-1
Groundwater Sample	Monitoring Well-Type-QC-Sequence	MW12-CO-N-1
Ambient Air Sample	Air Sampler-Sample Type-QC Type-Sequence	AIR01-TI-N-1

Note: Sequence is a numeric counter to make Sample ID unique if more than one sample is collected.

### Sample Types.

Sample Type Description	Code
Composite	CO
Grab	G
Product – DNAPL	PD
Product – LNAPL	PL
Split	SP
Time Integrated	TI

### QA/QC Types.

QA/QC Type Description	Code
Normal	N
Duplicate	D
Field Blank	FB
Rinse Blank	RB
Trip Blank	TB

<b>SOP</b>	<b>0110.04</b>				
<b>GROUP</b>	Database Management System				
<b>SUB-GROUP</b>	Data Collection and Acquisition				
<b>TITLE</b>	On-Site Sample Nomenclature - On-Site Sampling Activities				
<b>DATE</b>	9/1/2011	<b>FILE</b>	0110-04.doc	<b>PAGE</b>	1 of 1

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the remediation sample nomenclature for analytical samples. The sample nomenclature is based upon specific code requirements for compatibility with the WESTON On-Line system

## PROCEDURE

### Sampling Stations.

Station Type	Template
Soil Stockpile	SS##
Monitoring Well	MW##
Surface Water Pond	POND##
Air Sampler	AIR##

### Sample Nomenclature.

Sample Type	Template	Example
Soil Composite Sample	Stockpile - Type - QC - Sequence	SS01-CO-N-1
Surface Water Sample	Surface Water Pond-Type-QC-Sequence	POND03-CO-N-1
Groundwater Sample	Monitoring Well-Type-QC-Sequence	MW12-CO-N-1
Ambient Air Sample	Air Sampler-Sample Type-QC Type-Sequence	AIR01-TI-N-1

Note: Sequence is a numeric counter to make Sample ID unique if more than one sample is collected.

### Sample Types.

Sample Type Description	Code
Composite	CO
Grab	G
Product – DNAPL	PD
Product – LNAPL	PL
Split	SP
Time Integrated	TI

### QA/QC Types.

QA/QC Type Description	Code
Normal	N
Duplicate	D
Field Blank	FB
Rinse Blank	RB
Trip Blank	TB



<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	<b>9/1/2011</b>	<b>FILE</b>	1101-01.doc	<b>PAGE</b>	2 of 4

A COC form will be completed each time a sample or group of samples is prepared for transfer to the laboratory. The form will repeat the information on each of the sample labels and will serve as documentation of handling during shipment. The minimum information requirements of the COC form are listed in Table 1101.01-A. An example COC form is shown in Figure 1101.01-A. The completed COC must be reviewed by the Field Team Leader or Site Manager prior to sample shipment. The COC form will remain each sample shipping container at all times, and another copy will be retained by the member of the sampling team who originally relinquished the samples or in a project file.

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<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	9/1/2011	<b>FILE</b>	1101-01.doc	<b>PAGE</b>	3 of 4

**TABLE 1101.01-A CHAIN OF CUSTODY FORM**

<b>INFORMATION</b>	<b>COMPLETED BY</b>	<b>DESCRIPTION</b>
<b>COC</b>	Laboratory	enter a unique number for each chain of custody form
<b>SHIP TO</b>	Field Team	enter the laboratory name and address
<b>CARRIER</b>	Field Team	enter the name of the transporter (e.g., FedEx) or handcarried
<b>AIRBILL</b>	Field Team	enter the airbill number or transporter tracking number (if applicable)
<b>PROJECT NAME</b>	Field Team	enter the project name
<b>SAMPLER NAME</b>	Field Team	enter the name of the person collecting the samples
<b>SAMPLER SIGNATURE</b>	Field Team	signature of the person collecting the samples
<b>SEND RESULTS TO</b>	Field Team	enter the name and address of the prime contractor
<b>FIELD SAMPLE ID</b>	Field Team	enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)
<b>DATE</b>	Field Team	enter the year and date the sample was collected in the format M/D (e.g., 6/3)
<b>TIME</b>	Field Team	enter the time the sample was collected in 24 hour format (e.g., 0900)
<b>MATRIX</b>	Field Team	enter the sample matrix (e.g., water, soil)
<b>PRESERVATIVE</b>	Field Team	enter the preservative used (e.g., HNO3) or "none"
<b>FILTERED/ UNFILTERED</b>	Field Team	enter "F" if the sample was filtered or "U" if the sample was not filtered
<b>CONTAINERS</b>	Field Team	enter the number of containers associated with the sample
<b>MS/MSD</b>	Field Team or Laboratory	enter "X" if the sample is designated for the MS/MSD
<b>ANALYSES REQUESTED</b>	Field Team	enter the method name of the analysis requested (e.g., SW6010A)
<b>COMMENTS</b>	Field Team	enter comments
<b>SAMPLE CONDITION UPON RECEIPT AT LABORATORY</b>	Laboratory	enter any problems with the condition of any sample(s)
<b>COOLER TEMPERATURE</b>	Laboratory	enter the internal temperature of the cooler, in degrees C, upon opening
<b>SPECIAL INSTRUCTIONS/COMMENTS</b>	Laboratory	enter any special instructions or comments
<b>RELEASED BY (SIG)</b>	Field Team and Laboratory	enter the signature of the person releasing custody of the samples
<b>COMPANY NAME</b>	Field Team and Laboratory	enter the company name employing the person releasing/receiving custody
<b>RECEIVED BY (SIG)</b>	Field Team and Laboratory	enter the signature of the person receiving custody of the samples
<b>DATE</b>	Field Team and Laboratory	enter the date in the format M/D/YY (e.g., 6/3/96) when the samples were released/received
<b>TIME</b>	Field Team and Laboratory	enter the date in 24 hour format (e.g., 0900) when the samples were released/received

<b>SOP</b>	<b>1101.01</b>				
<b>GROUP</b>	Sampling Handling				
<b>SUB-GROUP</b>	Sample Custody				
<b>TITLE</b>	Sample Custody in the Field				
<b>DATE</b>	<b>9/1/2011</b>	<b>FILE</b>	1101-01.doc	<b>PAGE</b>	4 of 4

**FIGURE 1101.01-A CHAIN OF CUSTODY FORM**

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<b>SOP</b>	<b>1102.01</b>				
<b>GROUP</b>	Sample Handling				
<b>SUB-GROUP</b>	Sample Shipping				
<b>TITLE</b>	Sample Shipping				
<b>DATE</b>	9/1/2011	<b>FILE</b>	1102-01.DOC	<b>PAGE</b>	1 of 1

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the procedures for sample shipping that will be implemented during field work involving sampling activities.

## TERMS

COC - Chain-of-Custody

## PROCEDURE

Prior to shipping or transferring custody of samples, they will be packed according to D.O.T. requirements with sufficient ice to maintain an internal temperature of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  during transport to the laboratory. Samples relinquished to the participating laboratories will be subject to the following procedures for transfer of custody and shipment:

1. Samples will be accompanied by a COC record. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the sample transfer on the record. If sent by common carrier, a bill of lading or airbill should be used. Bill of lading and airbill receipts will be retained in the project file as part of the permanent documentation of sample shipping and transfer. This custody record documents transfer of sample custody from the sampler to another person or to the laboratory. The designated laboratory will accept custody in the field upon sample pick-up or at the laboratory if the samples are delivered via field personnel or a courier service.
2. Samples will be properly packed in approved shipping containers for laboratory pick-up by the appropriate laboratory for analysis, with separate, signed custody records enclosed in each sample box or cooler. Sample shipping containers will be padlocked or custody-sealed for transfer to the laboratory. The preferred procedure includes use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal will then be folded over and stuck to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal will then be signed. The designated laboratory will accept custody of the samples upon receipt.
3. Whenever samples are split with state representatives or other parties, the COC record will be marked to indicate with whom the samples were split.
4. The field sampler will call the designated laboratory to inform them of sample shipment and verify sample receipt as necessary.

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	9/1/2011	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	1 of 3

## INTRODUCTION

The following Standard Operating Procedure (SOP) presents the methods used for minimizing the potential for cross-contamination, and provides general guidelines for sampling equipment decontamination procedures.

## PROCEDURE

As part of the Health and Safety Plan (HASP), develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The decontamination plan should include the following:

- The number, location, and layout of decontamination stations
- Which decontamination apparatus is needed
- The appropriate decontamination methods
- Methods for disposal of contaminated clothing, apparatus, and solutions

### Decontamination Methods

Personnel, samples, and equipment leaving the contaminated area of a site will be decontaminated. Various decontamination methods will be used to either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or both. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

#### *Abrasive Cleaning Methods*

Abrasive cleaning methods work by rubbing/scrubbing the surface containing the contaminant. This method includes mechanical and wet blasting methods.

Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.

Cleaning can also be accomplished by water blasting which is also referred to as steam cleaning and pressure washing. Pressure washing utilizes high-pressure that is sprayed from a nozzle onto sampling equipment to physically remove soil or (potentially) contaminated material. Steam cleaning is a modification of pressure washing where the water is heated to temperatures approaching 100°C to assist in removing organic constituents from equipment.

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	9/1/2011	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	2 of 3

### *Disinfection/Rinse Methods*

Disinfectants are a practical means of inactivating chemicals or contaminants of concern. Standard sterilization methods involve heating the equipment which is impractical for large equipment. Rinsing removes contaminants through dilution, physical attraction, and solubilization.

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be target analyte free. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions. An untreated potable water supply is not an acceptable substitute for tap water. Acids and solvents are occasionally utilized in decontamination of equipment to remove metals and organics, respectively, from sampling equipment. Other than ethanol, these are avoided when possible due to the safety, disposal, and transportation concerns associated with them.

Equipment or apparatuses that may be selected for use include the following:

- Personal protective clothing
- Non-phosphate detergent
- Selected solvents for removal of polar and nonpolar organics (ethanol, methanol, hexane)
- Acid washes for removal of metals (nitric acid)
- Long-handled brushes
- Drop cloths or plastic sheeting
- Paper towels
- Galvanized tubs or buckets
- Distilled, deionized, or tap water (as required by the project)
- Storage containers for spent wash solutions
- Sprayers (pressurized and non-pressurized)
- Trash bags
- Safety glasses or splash shield

### Field Sampling Equipment Cleaning Procedures

The following procedures should be followed:

1. Where applicable, follow physical removal procedures previously described (pressure wash, scrub wash)
2. Wash equipment with a non-phosphate detergent solution
3. Rinse with tap water
4. Rinse with distilled or deionized water
5. Rinse with 10% nitric acid if the sample will be analyzed for metals/organics
6. Rinse with distilled or deionized water
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics
8. Air dry the equipment completely
9. Rinse again with distilled or deionized water

<b>SOP</b>	<b>1201.01</b>				
<b>GROUP</b>	Decontamination				
<b>SUB-GROUP</b>	Sampling Equipment Decontamination				
<b>TITLE</b>	Sampling Equipment Decontamination				
<b>DATE</b>	9/1/2011	<b>FILE</b>	1201-01.DOC	<b>PAGE</b>	3 of 3

10. Place in clean bag or container for storage/transport to subsequent sampling locations.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if the analyses do not include inorganics. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, ethanol, hexane, methanol, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the ten-step decontamination procedure listed above may be modified for site specificity.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing before commencement of sampling and between sampling locations. Plastic tubing should not be reused.

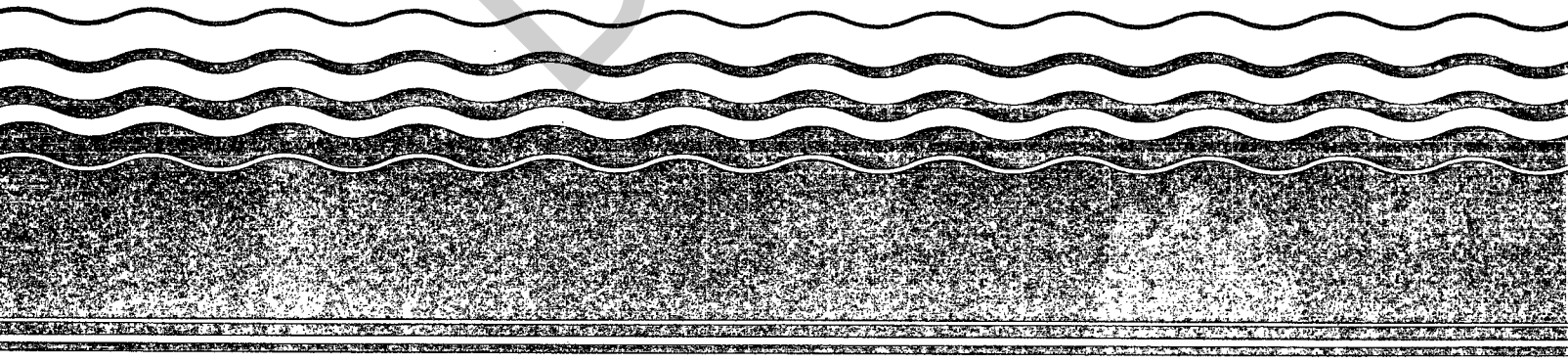
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9360.4-02



# Compendium of ERT Soil Sampling and Surface Geophysics Procedures

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# COMPENDIUM OF ERT SOIL SAMPLING AND SURFACE GEOPHYSICS PROCEDURES

Sampling Equipment Decontamination

Soil Sampling

Soil Gas Sampling

General Surface Geophysics

Interim Final

Environmental Response Team  
Emergency Response Division

Office of Emergency and Remedial Response  
U.S. Environmental Protection Agency  
Washington, DC 20460



Printed on Recycled Paper

## Notice

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Depending on circumstances and needs, it may not be possible or appropriate to follow these procedures exactly in all situations due to site conditions, equipment limitations, and limitations of the standard procedures. Whenever these procedures cannot be followed as written, they may be used as general guidance with any and all modifications fully documented in either QA Plans, Sampling Plans, or final reports of results.

Each Standard Operating Procedure in this compendium contains a discussion on quality assurance/quality control (QA/QC). For more information on QA/QC objectives and requirements, refer to the *Quality Assurance/Quality Control Guidance for Removal Activities*, OSWER directive 9360.4-01, EPA/540/G-90/004.

Questions, comments, and recommendations are welcomed regarding the Compendium of ERT Soil Sampling and Surface Geophysics Procedures. Send remarks to:

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(703) 487-4600

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## 1.0 SAMPLING EQUIPMENT DECONTAMINATION: SOP #2006

### 1.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures at a hazardous waste site. Preventing or minimizing cross-contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel.

Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

### 1.2 METHOD SUMMARY

Contaminants can be physically removed from equipment, or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and non-abrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water cleaning, followed by a wash/rinse process using appropriate cleaning solutions. Use of a solvent rinse is required when organic contamination is present.

### 1.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

### 1.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment

provided that it has been verified by laboratory analysis to be analyte free.

- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions.
- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.
- The site work plan must address disposal of the spent decontamination solutions.
- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

- Stress work practices that minimize contact with hazardous substances.

- Use remote sampling, handling, and container-opening techniques when appropriate.

- Cover monitoring and sampling equipment with protective material to minimize contamination.

- Use disposable outer garments and disposable sampling equipment when appropriate.

### 1.5 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water



- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

## 1.6 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions and solvents. In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid<sup>(1)</sup>
- acetone (pesticide grade)<sup>(2)</sup>
- hexane (pesticide grade)<sup>(2)</sup>
- methanol

<sup>(1)</sup> Only if sample is to be analyzed for trace metals.

<sup>(2)</sup> Only if sample is to be analyzed for organics.

## 1.7 PROCEDURES

As part of the health and safety plan, develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- the number, location, and layout of decontamination stations
- which decontamination apparatus is needed
- the appropriate decontamination methods
- methods for disposal of contaminated clothing, apparatus, and solutions

### 1.7.1 Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or do both.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

### *Abrasive Cleaning Methods*

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available:

- **Mechanical:** Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.
- **Air Blasting:** Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs or auger bits. The equipment used in air blast cleaning employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages: it is unable to control the amount of material removed, it can aerate contaminants, and it generates large amounts of waste.
- **Wet Blasting:** Wet blast cleaning, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. This method generates a large amount of waste.

### *Non-Abrasive Cleaning Methods*

Non-abrasive cleaning methods work by forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods. The following non-abrasive methods are available:

- **High-Pressure Water:** This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) which relates to flow rates of 20 to 140 liters per minute.
- **Ultra-High-Pressure Water:** This system produces a pressurized water jet (from 1,000 to 4,000 atm). The ultra-high-pressure spray removes tightly-adhered surface film. The water velocity ranges from 500 m/sec (1,000 atm) to 900 m/sec (4,000 atm). Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

### *Disinfection/Rinse Methods*

- **Disinfection:** Disinfectants are a practical means of inactivating infectious agents.
- **Sterilization:** Standard sterilization methods involve heating the equipment. Sterilization is impractical for large equipment.
- **Rinsing:** Rinsing removes contaminants through dilution, physical attraction, and solubilization.

### **1.7.2 Field Sampling Equipment Cleaning Procedures**

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Where applicable, follow physical removal procedures specified in section 1.7.1.
2. Wash equipment with a non-phosphate detergent solution.
3. Rinse with tap water.
4. Rinse with distilled/deionized water.
5. Rinse with 10% nitric acid if the sample will be analyzed for trace organics.

6. Rinse with distilled/deionized water.
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics.
8. Air dry the equipment completely.
9. Rinse again with distilled/deionized water.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the contaminants of concern at the site.

Table 1 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air dried and rinsed with distilled/deionized water.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

## **1.8 CALCULATIONS**

This section is not applicable to this SOP.

## **1.9 QUALITY ASSURANCE/QUALITY CONTROL**

One type of quality control sample specific to the field decontamination process is the rinsate blank. The rinsate blank provides information on the effectiveness of the decontamination process employed in the field. When used in conjunction with field blanks and trip blanks, a rinsate blank can detect contamination during sample handling, storage and sample transportation to the laboratory.

Table 1: Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS
Water	<ul style="list-style-type: none"> <li>• Low-chain hydrocarbons</li> <li>• Inorganic compounds</li> <li>• Salts</li> <li>• Some organic acids and other polar compounds</li> </ul>
Dilute Acids	<ul style="list-style-type: none"> <li>• Basic (caustic) compounds</li> <li>• Amines</li> <li>• Hydrazines</li> </ul>
Dilute Bases -- for example, detergent and soap	<ul style="list-style-type: none"> <li>• Metals</li> <li>• Acidic compounds</li> <li>• Phenol</li> <li>• Thiols</li> <li>• Some nitro and sulfonic compounds</li> </ul>
Organic Solvents <sup>(1)</sup> - for example, alcohols, ethers, ketones, aromatics, straight-chain alkanes (e.g., hexane), and common petroleum products (e.g., fuel, oil, kerosene)	<ul style="list-style-type: none"> <li>• Nonpolar compounds (e.g., some organic compounds)</li> </ul>

<sup>(1)</sup> - WARNING: Some organic solvents can permeate and/or degrade protective clothing.

A rinsate blank consists of a sample of analyte-free (i.e., deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container.

Rinsate blanks should be run for all parameters of interest at a rate of 1 per 20 for each parameter, even if samples are not shipped that day. Rinsate blanks are not required if dedicated sampling equipment is used.

## 1.10 DATA VALIDATION

This section is not applicable to this SOP.

## 1.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect

health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment; some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

The decontamination solutions and solvents must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods pose a direct health hazard, measures should be taken to protect personnel or the methods should be modified to eliminate the hazard.

## 2.0 SOIL SAMPLING: SOP #2012

### 2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

### 2.2 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, a trier, a split-spoon, or, if required, a backhoe.

### 2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Refrigeration to 4°C, supplemented by a minimal holding time, is usually the best approach.

### 2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with soil sampling. These include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required,

resulting in variable, non-representative results.

### 2.5 EQUIPMENT/APPARATUS

- sampling plan
- maps/plot plan
- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- extension rods
- T-handle
- sampling trier
- thin-wall tube sampler
- Vehimeyer soil sampler outfit
  - tubes
  - points
  - drive head
  - drop hammer
  - puller jack and grip
- backhoe

### 2.6 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in

## 2.7 PROCEDURES

### 2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner prior to soil sampling.

### 2.7.2 Sample Collection

#### *Surface Soil Samples*

Collect samples from near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

This method can be used in most soil types but is limited to sampling near surface areas. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other

applications. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

#### *Sampling at Depth with Augers and Thin-Wall Tube Samplers*

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Appendix A, Figure 1). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct

sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

Follow these procedures for collecting soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.
5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled container(s) and secure the cap(s) tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

### *Sampling at Depth with a Trier*

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

Follow these procedures to collect soil samples with a sampling trier.

1. Insert the trier (Appendix A, Figure 2) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

### *Sampling at Depth with a Split Spoon (Barrel) Sampler*

The procedure for split spoon sampling describes the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split tube sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-67 (reapproved 1974).

Follow these procedures for collecting soil samples with a split spoon.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit onto the bottom and the heavier head piece onto the top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a sledge hammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece or compression of the

sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in diameters of 2 and 3 1/2 inches. However, in order to obtain the required sample volume, use of a larger barrel may be required.
6. Without disturbing the core, transfer it to an appropriate labeled sample container(s) and seal tightly.

### *Test Pit/Trench Excavation*

These relatively large excavations are used to remove sections of soil, when detailed examination of soil characteristics (horizontal structure, color, etc.) are required. It is the least cost effective sampling method due to the relatively high cost of backhoe operation.

Follow these procedures for collecting soil samples from test pit/trench excavations.

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface).
2. Using the backhoe, dig a trench to approximately 3 feet in width and approximately 1 foot below the cleared sampling location. Place removed or excavated soils on plastic sheets. Trenches greater than 5 feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
3. Use a shovel to remove a 1- to 2-inch layer of soil from the vertical face of the pit where sampling is to be done.
4. Take samples using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling

to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

5. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.
6. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

## **2.8 CALCULATIONS**

This section is not applicable to this SOP.

## **2.9 QUALITY ASSURANCE/ QUALITY CONTROL**

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **2.10 DATA VALIDATION**

This section is not applicable to this SOP.

## **2.11 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.



## 3.0 SOIL GAS SAMPLING: SOP #2149

### 3.1 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of waste site evaluation. Using this method, underground contamination can be identified, and the source, extent, and movement of the pollutants can be traced.

This Standard Operating Procedure (SOP) outlines the methods used by EPA/ERT in installing soil gas wells; measuring organic levels in the soil gas using an HNU PI 101 Portable Photoionization Analyzer and/or other air monitoring devices; and sampling the soil gas using Tedlar bags, Tenax sorbent tubes, and SUMMA canisters.

### 3.2 METHOD SUMMARY

A 3/8-inch diameter hole is driven into the ground to a depth of 4 to 5 feet using a commercially available "slam bar". (Soil gas can also be sampled at other depths by the use of a longer bar or bar attachments.) A 1/4-inch O.D. stainless steel probe is inserted into the hole. The hole is then sealed at the top around the probe using modeling clay. The gas contained in the interstitial spaces of the soil is sampled by pulling the sample through the probe using an air sampling pump. The sample may be stored in Tedlar bags, drawn through sorbent cartridges, or analyzed directly using a direct reading instrument.

The air sampling pump is not used for SUMMA canister sampling of soil gas. Sampling is achieved by soil gas equilibration with the evacuated SUMMA canister. Other field air monitoring devices, such as the combustible gas indicator (MSA CGI/02 Meter, Model 260) and the organic vapor analyzer (Foxboro OVA, Model 128), can also be used depending on specific site conditions. Measurement of soil temperature using a temperature probe may also be desirable. Bagged samples are usually analyzed in a field laboratory using a portable Photovac GC.

Power driven sampling probes may be utilized when soil conditions make sampling by hand unfeasible (i.e., frozen ground, very dense clays, pavement,

etc.). Commercially available soil gas sampling probes (hollow, 1/2-inch O.D. steel probes) can be driven to the desired depth using a power hammer (e.g., Bosch Demolition Hammer). Samples can be drawn through the probe itself, or through Teflon tubing inserted through the probe and attached to the probe point. Samples are collected and analyzed as described above.

### 3.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

#### 3.3.1 Tedlar Bag

Soil gas samples are generally contained in 1-L Tedlar bags. Bagged samples are best stored in coolers to protect the bags from any damage that may occur in the field or in transit. In addition, coolers ensure the integrity of the samples by keeping them at a cool temperature and out of direct sunlight. Samples should be analyzed as soon as possible, preferably within 24 to 48 hours.

#### 3.3.2 Tenax Tube

Bagged samples can also be drawn into Tenax or other sorbent tubes to undergo lab GC/MS analysis. If Tenax tubes are to be utilized, special care must be taken to avoid contamination. Handling of the tubes should be kept to a minimum, and samplers must wear nylon or other lint-free gloves. After sampling, each tube should be stored in a clean, sealed culture tube; the ends packed with clean glass wool to protect the sorbent tube from breakage. The culture tubes should be kept cool and wrapped in aluminum foil to prevent any photodegradation of samples (see Section 3.7.4.).

#### 3.3.3 SUMMA Canister

The SUMMA canisters used for soil gas sampling have a 6-L sample capacity and are certified clean by GC/MS analysis before being utilized in the field. After sampling is completed, they are stored and shipped in travel cases.

### 3.4 INTERFERENCES AND POTENTIAL PROBLEMS

#### 3.4.1 HNU Measurements

A number of factors can affect the response of the HNU PI 101. High humidity can cause lamp fogging and decreased sensitivity. This can be significant when soil moisture levels are high, or when a soil gas well is actually in groundwater. High concentrations of methane can cause a downscale deflection of the meter. High and low temperature, electrical fields, FM radio transmission, and naturally occurring compounds, such as terpenes in wooded areas, will also affect instrument response.

Other field screening instruments can be affected by interferences. Consult the manufacturers' manuals.

#### 3.4.2 Factors Affecting Organic Concentrations in Soil Gas

Concentrations in soil gas are affected by dissolution, adsorption, and partitioning. Partitioning refers to the ratio of component found in a saturated vapor above an aqueous solution to the amount in the solution; this can, in theory, be calculated using the Henry's Law constants. Contaminants can also be adsorbed onto inorganic soil components or "dissolved" in organic components. These factors can result in a lowering of the partitioning coefficient.

Soil "tightness" or amount of void space in the soil matrix, will affect the rate of recharging of gas into the soil gas well.

Existence of a high, or perched, water table, or of an impermeable underlying layer (such as a clay lens or layer of buried slag) may interfere with sampling of the soil gas. Knowledge of site geology is useful in such situations, and can prevent inaccurate sampling.

#### 3.4.3 Soil Probe Clogging

A common problem with this sampling method is soil probe clogging. A clogged probe can be identified by using an in-line vacuum gauge or by listening for the sound of the pump laboring. This problem can usually be eliminated by using a wire cable to clear the probe (see procedure #3 in Section 3.7.1).

#### 3.4.4 Underground Utilities

Prior to selecting sample locations, an underground utility search is recommended. The local utility companies can be contacted and requested to mark the locations of their underground lines. Sampling plans can then be drawn up accordingly. Each sample location should also be screened with a metal detector or magnetometer to verify that no underground pipes or drums exist.

### 3.5 EQUIPMENT/APPARATUS

#### 3.5.1 Slam Bar Method

- slam bar (one per sampling team)
- soil gas probes, stainless steel tubing, 1/4-inch O.D., 5 foot length
- flexible wire or cable used for clearing the tubing during insertion into the well
- "quick connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box
- modeling clay
- vacuum box for drawing a vacuum around Tedlar bag for sample collection (one per sampling team)
- Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (one to two per sampling team)
- 1/4-inch Teflon tubing, 2 to 3 foot lengths, for replacement of contaminated sample line
- Tedlar bags, 1 liter, at least one bag per sample point
- soil gas sampling labels, field data sheets, logbook, etc.
- HNU Model PI 101, or other field air monitoring devices, (one per sampling team)
- ice chest, for carrying equipment and for protection of samples (two per sampling team)
- metal detector or magnetometer, for detecting underground utilities/pipes/drums (one per sampling team)
- Photovac GC, for field-lab analysis of bagged samples
- SUMMA canisters (plus their shipping cases) for sample, storage and transportation

### 3.5.2 Power Hammer Method

- Bosch demolition hammer
- 1/2-inch O.D. steel probes, extensions, and points
- dedicated aluminum sampling points
- Teflon tubing, 1/4-inch O.D.
- "quick connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box
- modeling clay
- vacuum box for drawing a vacuum around Tedlar bag for sample collection (one per sampling team)
- Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (one to two per sampling team)
- 1/4-inch Teflon tubing, 2 to 3 foot lengths, for replacement of contaminated sample line
- Tedlar bags, 1 liter, at least one bag per sample point
- soil gas sampling labels, field data sheets, logbook, etc.
- HNU Model PI 101, or other field air monitoring devices, (one per sampling team)
- ice chest, for carrying equipment and for protection of samples (two per sampling team)
- metal detector or magnetometer, for detecting underground utilities/pipes/drums (one per sampling team)
- Photovac GC, for field-lab analysis of bagged samples
- SUMMA canisters (plus their shipping cases) for sample, storage and transportation
- generator with extension cords
- high lift jack assembly for removing probes

### 3.6 REAGENTS

- HNU Systems Inc. Calibration Gas for HNU Model PI 101, and/or calibration gas for other field air monitoring devices
- deionized organic-free water, for decontamination
- methanol, HPLC grade, for decontamination
- ultra-zero grade compressed air, for field blanks

- standard gas preparations for Photovac GC calibration and Tedlar bag spikes

## 3.7 PROCEDURES

### 3.7.1 Soil Gas Well Installation

1. Initially, make a hole slightly deeper than the desired depth. For sampling up to 5 feet, use a 5-foot single piston slam bar. For deeper depths, use a piston slam bar with threaded 4-foot-long extensions. Other techniques can be used, so long as holes are of narrow diameter and no contamination is introduced.
2. After the hole is made, carefully withdraw the slam bar to prevent collapse of the walls of the hole. Then insert the soil gas probe.
3. It is necessary to prevent plugging of the probe, especially for deeper holes. Place a metal wire or cable, slightly longer than the probe, into the probe prior to inserting into the hole. Insert the probe to full depth, then pull it up 3 to 6 inches, then clear it by moving the cable up and down. The cable is removed before sampling.
4. Seal the top of the sample hole at the surface against ambient air infiltration by using modeling clay molded around the probe at the surface of the hole.
5. If conditions preclude hand installation of the soil gas wells, the power driven system may be employed. Use the generator-powered demolition hammer to drive the probe to the desired depth (up to 12 feet may be attained with extensions). Pull the probe up 1 to 3 inches if the retractable point is used. No clay is needed to seal the hole. After sampling, retrieve the probe using the high lift jack assembly.
6. If semi-permanent soil gas wells are required, use the dedicated aluminum probe points. Insert these points into the bottom of the power-driven probe and attach it to the Teflon tubing. Insert the probe as in step 5. When the probe is removed, the point and Teflon tube remain in the hole, which may be sealed by backfilling with sand, bentonite, or soil.

### 3.7.2 Screening with Field Instruments

1. The well volume **must** be evacuated prior to sampling. Connect the Gilian pump, adjusted to 3.0 L/min, to the sample probe using a section of Teflon tubing as a connector. Turn the pump on, and a vacuum is pulled through the probe for approximately 15 seconds. A longer time is required for sample wells of greater depths.
2. After evacuation, connect the monitoring instrument(s) to the probe using a Teflon connector. When the reading is stable, or peaks, record the reading. For detailed procedures on HNU field protocol, see appendix B, and refer to the manufacturer's instructions.
3. Some readings may be above or below the range set on the field instruments. The range may be reset, or the response recorded as a figure greater than or less than the range. Consider the recharge rate of the well with soil gas when sampling at a different range setting.

### 3.7.3 Tedlar Bag Sampling

1. Follow step 1 in section 3.7.2 to evacuate well volume. If air monitoring instrument screening was performed prior to sampling, evacuation is not necessary.
2. Use the vacuum box and sampling train (Figure 3 in Appendix A) to take the sample. The sampling train is designed to minimize the introduction of contaminants and losses due to adsorption. All wetted parts are either Teflon or stainless steel. The vacuum is drawn indirectly to avoid contamination from sample pumps.
3. Place the Tedlar bag inside the vacuum box, and attach it to the sampling port. Attach the sample probe to the sampling port via Teflon tubing and a "quick connect" fitting.
4. Draw a vacuum around the outside of the bag, using a Gilian pump connected to the vacuum box evacuation port, via Tygon tubing and a "quick connect" fitting. The vacuum causes the bag to inflate, drawing the sample.

5. Break the vacuum by removing the Tygon line from the pump. Remove the bagged sample from the box and close valve. Label bag, record data on data sheets or in logbooks. Record the date, time, sample location ID, and the HNU, or other instrument reading(s) on sample bag label.

**CAUTION:** Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material, contaminating the sample. Place labels on the edge of the bags, or tie the labels to the metal eyelets provided on the bags. Markers with inks containing volatile organics (i.e., permanent ink markers) should not be used.

### 3.7.4 Tenax Tube Sampling

Samples collected in Tedlar bags may be sorbed onto Tenax tubes for further analysis by GC/MS.

#### *Additional Apparatus*

- Syringe with a luer-lock tip capable of drawing a soil gas or air sample from a Tedlar bag onto a Tenax/CMS sorbent tube. The syringe capacity is dependent upon the volume of sample being drawn onto the sorbent tube.
- Adapters for fitting the sorbent tube between the Tedlar bag and the sampling syringe. The adapter attaching the Tedlar bag to the sorbent tube consists of a reducing union (1/4-inch to 1/16-inch O.D. -- Swagelok cat. # SS-400-6-ILV or equivalent) with a length of 1/4-inch O.D. Teflon tubing replacing the nut on the 1/6-inch (Tedlar bag) side. A 1/4-inch I.D. silicone O-ring replaces the ferrules in the nut on the 1/4-inch (sorbent tube) side of the union.

The adapter attaching the sampling syringe to the sorbent tube consists of a reducing union (1/4-inch to 1/16-inch O.D. -- Swagelok Cat. # SS-400-6-ILV or equivalent) with a 1/4-inch I.D. silicone O-ring replacing the ferrules in the nut on the 1/4-inch (sorbent tube) side and the needle of a luer-lock syringe needle inserted into the 1/16-inch side (held in place with a 1/16-inch ferrule). The

luer-lock end of the needle can be attached to the sampling syringe. It is useful to have a luer-lock on/off valve situated between the syringe and the needle.

- Two-stage glass sampling cartridge (1/4-inch O.D. x 1/8-inch I.D. x 5 1/8 inch) contained in a flame-sealed tube (manufactured by Supelco Custom Tenax/Spherocarb Tubes or equivalent) containing two sorbent sections retained by glass wool:

Front section: 150 mg of Tenax-GC

Back section: 150 mg of CMS

(Carbonized Molecular Sieve)

Sorbent tubes may also be prepared in the lab and stored in either Teflon-capped culture tubes or stainless steel tube containers. Sorbent tubes stored in this manner should not be kept more than 2 weeks without reconditioning. (See SOP #2052 for Tenax/CMS sorbent tube preparation).

- Teflon-capped culture tubes or stainless steel tube containers for sorbent tube storage. These containers should be conditioned by baking at 120°C for at least 2 hours. The culture tubes should contain a glass wool plug to prevent sorbent tube breakage during transport. Reconditioning of the containers should occur between usage or after extended periods of disuse (i.e., 2 weeks or more).
- Nylon gloves or lint-free cloth. (Hewlett Packard Part # 8650-0030 or equivalent.)

### *Sample Collection*

1. Handle sorbent tubes with care, using nylon gloves (or other lint-free material) to avoid contamination.
2. Immediately before sampling, break one end of the sealed tube and remove the Tenax cartridge. For in-house prepared tubes, remove cartridge from its container.
3. Connect the valve on the Tedlar bag to the sorbent tube adapter. Connect the sorbent tube to the sorbent tube adapter with the Tenax

(white granular) side of the tube facing the Tedlar bag.

4. Connect the sampling syringe assembly to the CMS (black) side of the sorbent tube. Fittings on the adapters should be very tight.
5. Open the valve on the Tedlar bag.
6. Open the on/off valve of the sampling syringe.
7. Draw a predetermined volume of sample onto the sorbent tube. (This may require closing the syringe valve, emptying the syringe and then repeating the procedure, depending upon the syringe capacity and volume of sample required.)
8. After sampling, remove the tube from the sampling train with gloves or a clean cloth. **Do not label or write on the Tenax/CMS tube.**
9. Place the sorbent tube in a conditioned stainless steel tube holder or culture tube. Culture tube caps should be sealed with Teflon tape.

### *Sample Labeling*

Each sample tube container (not tube) must be labeled with the site name, sample station number, sample date, and sample volume.

Chain of custody forms must accompany all samples to the laboratory.

### *Quality Assurance*

Before field use, a QA check should be performed on each batch of sorbent tubes by analyzing a tube with thermal desorption/cryogenic trapping GC/MS.

At least one blank sample must be submitted with each set of samples collected at a site. This trip blank must be treated the same as the sample tubes except no sample will be drawn through the tube.

Sample tubes should be stored out of UV light (i.e., sunlight) and kept on ice until analysis.

Samples should be taken in duplicate, when possible.

### 3.7.5 SUMMA Canister Sampling

1. Follow item 1 in step 3.7.2 to evacuate well volume. If HNU analysis was performed prior to taking a sample, evacuation is not necessary.
2. Attach a certified clean, evacuated 6-L SUMMA canister via the 1/4-inch Teflon tubing.
3. Open the valve on SUMMA canister. The soil gas sample is drawn into the canister by pressure equilibration. The approximate sampling time for a 6-L canister is 20 minutes.
4. Site name, sample location, number, and date must be recorded on a chain of custody form and on a blank tag attached to the canister.

## 3.8 CALCULATIONS

### 3.8.1 Field Screening Instruments

Instrument readings are usually read directly from the meter. In some cases, the background level at the soil gas station may be subtracted:

$$\text{Final Reading} = \text{Sample Reading} - \text{Background}$$

### 3.8.2 Photovac GC Analysis

Calculations used to determine concentrations of individual components by Photovac GC analysis are beyond the scope of this SOP and are covered in ERT SOP #2109, Photovac GC Analysis for Soil, Water and Air/Soil Gas.

## 3.9 QUALITY ASSURANCE/ QUALITY CONTROL

### 3.9.1 Field Instrument Calibration

Consult the manufacturers' manuals for correct use and calibration of all instrumentation. The HNU should be calibrated at least once a day.

### 3.9.2 Gilian Model HFS113A Air Sampling Pump Calibration

Flow should be set at approximately 3.0 L/min;

accurate flow adjustment is not necessary. Pumps should be calibrated prior to bringing into the field.

### 3.9.3 Sample Probe Contamination

Sample probe contamination is checked between each sample by drawing ambient air through the probe via a Gilian pump and checking the response of the HNU PI 101. If HNU readings are higher than background, replacement or decontamination is necessary.

Sample probes may be decontaminated simply by drawing ambient air through the probe until the HNU reading is at background. More persistent contamination can be washed out using methanol and water, then air drying. Having more than one probe per sample team will reduce lag times between sample stations while probes are decontaminated.

### 3.9.4 Sample Train Contamination

The Teflon line forming the sample train from the probe to the Tedlar bag should be changed on a daily basis. If visible contamination (soil or water) is drawn into the sampling train, it should be changed immediately. When sampling in highly contaminated areas, the sampling train should be purged with ambient air, via a Gilian pump, for approximately 30 seconds between each sample. After purging, the sampling train can be checked using an HNU, or other field monitoring device, to establish the cleanliness of the Teflon line.

### 3.9.5 Field Blank

Each cooler containing samples should also contain one Tedlar bag of ultra-zero grade air, acting as a field blank. The field blank should accompany the samples in the field (while being collected) and when they are delivered for analysis. A fresh blank must be provided to be placed in the empty cooler pending additional sample collection. One new field blank per cooler of samples is required. A chain of custody form must accompany each cooler of samples and should include the blank that is dedicated to that group of samples.

### 3.9.6 Trip Standard

Each cooler containing samples should contain a Tedlar bag of standard gas to calibrate the

analytical instruments (Photovac GC, etc.). This trip standard will be used to determine any changes in concentrations of the target compounds during the course of the sampling day (e.g., migration through the sample bag, degradation, or adsorption). A fresh trip standard must be provided and placed in each cooler pending additional sample collection. A chain of custody form should accompany each cooler of samples and should include the trip standard that is dedicated to that group of samples.

### 3.9.7 Tedlar Bag Check

Prior to use, one bag should be removed from each lot (case of 100) of Tedlar bags to be used for sampling and checked for possible contamination as follows: the test bag should be filled with ultra-zero grade air; a sample should be drawn from the bag and analyzed via Photovac GC or whatever method is to be used for sample analysis. This procedure will ensure sample container cleanliness prior to the start of the sampling effort.

### 3.9.8 SUMMA Canister Check

From each lot of four cleaned SUMMA canisters, one is to be removed for a GC/MS certification check. If the canister passes certification, then it is re-evacuated and all four canisters from that lot are available for sampling.

If the chosen canister is contaminated, then the entire lot of four SUMMA canisters must be recleaned, and a single canister is re-analyzed by GC/MS for certification.

### 3.9.9 Options

#### *Duplicate Samples*

A minimum of 5% of all samples should be collected in duplicate (i.e., if a total of 100 samples are to be collected, five samples should be duplicated). In choosing which samples to duplicate, the following criterion applies: if, after filling the first Tedlar bag, and, evacuating the well for 15 seconds, the second HNU (or other field monitoring device being used) reading matches or is close to (within 50%) the first reading, a duplicate sample may be taken.

### *Spikes*

A Tedlar bag spike and Tenax tube spike may be desirable in situations where high concentrations of contaminants other than the target compounds are found to exist (landfills, etc.). The additional level of QA/QC attained by this practice can be useful in determining the effects of interferences caused by these non-target compounds. SUMMA canisters containing samples are not spiked.

## 3.10 DATA VALIDATION

For each target compound, the level of concentration found in the sample must be greater than three times the level (for that compound) found in the field blank which accompanied that sample to be considered valid. The same criteria apply to target compounds detected in the Tedlar bag pre-sampling contamination check.

## 3.11 HEALTH AND SAFETY

Because the sample is being drawn from underground, and no contamination is introduced into the breathing zone, soil gas sampling usually occurs in Level D, unless the sampling location is within the hot zone of a site, which requires Level B or Level C protection. However, to ensure that the proper level of protection is utilized, constantly monitor the ambient air using the HNU PI 101 to obtain background readings during the sampling procedure. As long as the levels in ambient air do not rise above background, no upgrade of the level of protection is needed.

Also, perform an underground utility search prior to sampling (see section 3.4.4). When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

## 4.0 General Surface Geophysics: SOP #2159

### 4.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the general procedures used to acquire surface geophysical data. This data is used for delineating subsurface waste, and for interpreting geologic, hydrogeologic or other data related to hazardous waste site characterization.

The media pertinent to these surface geophysical methods are soil/rock and groundwater. The sensitivity or minimum response of a given method depends on the comparison of the object or area of study to that of its background (i.e., what the media's response would be like without the object of study). Therefore, the suitability of surface geophysical methods for a given investigation must be judged on the object's ability to be measured and the extent to which the specific setting of the study interferes with the measurement.

The surface geophysical method(s) selected for application at a site are dependent on site conditions, such as depth to bedrock, depth to target, urban disturbances (fences, power lines, surface debris, etc.) and atmospheric conditions. Detectability of the target is dependent on the sensitivity of the instrument and the variation of the field measurement from the ambient noise. Ambient noise is the pervasive noise associated with an environment. Therefore, the applicability of geophysical methods at a given site is dependent on the specific setting at that site.

Five geophysical methods may be utilized in hazardous waste site characterization: magnetometry, electromagnetics, resistivity, seismology and ground penetrating radar (GPR). Magnetometers may be used to locate buried ferrous metallic objects and geologic information. Electromagnetic methods can be used to determine the presence of metals, electrical conductivity of the terrain, and geologic information. Resistivity methods are used to determine the electrical resistivity of the terrain and geologic information. Seismic methods are useful in determining geologic stratigraphy and structure. GPR may be used to locate disturbance in the soil (i.e., trenches, buried utilities and fill boundaries) and some near-surface geologic information.

These procedures may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the procedures employed should be documented and associated with the final report.

### 4.2 METHOD SUMMARY

#### 4.2.1 Magnetics

A magnetometer is an instrument which measures magnetic field strength in units of gammas (nanoteslas). Local variations, or anomalies, in the earth's magnetic field are the result of disturbances caused mostly by variations in concentrations of ferromagnetic material in the vicinity of the magnetometer's sensor. A buried ferrous object, such as a steel drum or tank, locally distorts the earth's magnetic field and results in a magnetic anomaly. The objective of conducting a magnetic survey at a hazardous waste or groundwater pollution site is to map these anomalies and delineate the area containing buried sources of the anomalies.

Analysis of magnetic data can allow an experienced geophysicist to estimate the areal extent of buried ferrous targets, such as a steel tank or drum. Often, areas of burial can be prioritized upon examination of the data, with high priority areas indicating a near certainty of buried ferrous material. In some instances, estimates of depth of burial can be made from the data. Most of these depth estimates are graphical methods of interpretation, such as slope techniques and half-width rules, as described by Nettleton (1976). The accuracy of these methods is dependent upon the quality of the data and the skill of the interpreting geophysicist. An accuracy of 10 to 20 percent is considered acceptable. The magnetic method may also be used to map certain geologic features, such as igneous intrusions, which may play an important role in the hydrogeology of a groundwater pollution site.

#### Advantages

Advantages of using the magnetic method for the initial assessment of hazardous waste sites are the



relatively low cost of conducting the survey and the relative ease of completing a survey in a short amount of time. Little, if any, site preparation is necessary. Surveying requirements are not as stringent as for other methods and may be completed with a transit or Brunton-type pocket transit and a non-metallic measuring tape. Often, a magnetic investigation is a very cost-effective method for initial assessment of a hazardous waste site where buried steel drums or tanks are a concern.

### *Disadvantages*

"Cultural noise" is a limitation of the magnetic method in certain areas. Man-made structures that are constructed with ferrous material, such as steel, have a detrimental effect on the quality of the data. Avoid features such as steel structures, power lines, metal fences, steel reinforced concrete, pipelines and underground utilities. When these features are unavoidable, note their locations in a field notebook and on the site map.

Another limitation of the magnetic method is the inability of the interpretation methods to differentiate between various steel objects. For instance, it is not possible to determine if an anomaly is the result of a steel tank, or a group of steel drums, or old washing machines. Also, the magnetic method does not allow the interpreter to determine the contents of a buried tank or drum.

### **4.2.2 Electromagnetics**

The electromagnetic method is a geophysical technique based on the physical principles of inducing and detecting electrical current flow within geologic strata. A receiver detects these induced currents by measuring the resulting time-varying magnetic field. The electromagnetic method measures bulk conductivity (the inverse of resistivity) of geologic materials beneath the transmitter and receiver coils. Electromagnetics should not be confused with the electrical resistivity method. The difference between the two techniques is in the method which the electrical currents are forced to flow in the earth. In the electromagnetic method, currents are induced by the application of time-varying magnetic fields, whereas in the electrical resistivity method, current is injected into the ground through surface electrodes.

Electromagnetics can be used to locate pipes, utility

lines, cables, buried steel drums, trenches, buried waste, and concentrated contaminant plumes. The method can also be used to map shallow geologic features, such as lithologic changes and fault zones.

### *Advantages*

Electromagnetic measurements can be collected rapidly and with a minimum number of field personnel. Most electromagnetic equipment used in groundwater pollution investigations is lightweight and easily portable. The electromagnetic method is one of the more commonly used geophysical techniques applied to groundwater pollution investigations.

### *Disadvantages*

The main limitation of the electromagnetic method is "cultural noise". Sources of "cultural noise" can include: large metal objects, buried cables, pipes, buildings, and metal fences.

The electromagnetic method has limitations in areas where the geology varies laterally. These can cause conductivity anomalies or lineations, which might be misinterpreted as contaminant plumes.

### **4.2.3 Electrical Resistivity**

The electrical resistivity method is used to map subsurface electrical resistivity structure, which is in turn interpreted by the geophysicist to determine the geologic structure and/or physical properties of the geologic materials. Electrical resistivities of geologic materials are measured in ohm-meters, and are functions of porosity, permeability, water saturation and the concentration of dissolved solids in the pore fluids.

Resistivity methods measure the bulk resistivity of the subsurface, as do the electromagnetic methods. The difference between the two methods is in the way that electrical currents are forced to flow in the earth. In the electrical resistivity method, current is injected into the ground through surface electrodes, whereas in electromagnetic methods currents are induced by application of time-varying magnetic fields.

### *Advantages*

The principal advantage of the electrical resistivity method is that quantitative modeling is possible

using either computer software or published master curves. The resulting models can provide accurate estimates of depths, thicknesses and resistivities of subsurface layers. The layer resistivities can then be used to estimate the resistivity of the saturating fluid, which is related to the total concentration of dissolved solids in the fluid.

### *Disadvantages*

The limitations of using the resistivity method in groundwater pollution site investigations are largely due to site characteristics, rather than in any inherent limitations of the method. Typically, polluted sites are located in industrial areas that contain an abundance of broad spectrum electrical noise. In conducting a resistivity survey, the voltages are relayed to the receiver over long wires that are grounded at each end. These wires act as antennae receiving the radiated electrical noise that in turn degrades the quality of the measured voltages.

Resistivity surveys require a fairly large area, far removed from pipelines and grounded metallic structures such as metal fences, pipelines and railroad tracks. This requirement precludes using resistivity on many polluted sites. However, the resistivity method can often be used successfully off-site to map the stratigraphy of the area surrounding the site. A general "rule of thumb" for resistivity surveying is that grounded structures be at least half of the maximum electrode spacing distance away from the axis of the survey line.

Another consideration in the resistivity method is that the fieldwork tends to be more labor intensive than some other geophysical techniques. A minimum of two to three crew members are required for the fieldwork.

## **4.2.4 Seismic**

Surface seismic techniques used in groundwater pollution site investigations are largely restricted to seismic refraction and seismic reflection methods. The equipment used for both methods is fundamentally the same and both methods measure the travel-time of acoustic waves propagating through the subsurface. In the refraction method, the travel-time of waves refracted along an acoustic interface is measured, and in the reflection method, the travel-time of a wave which reflects or echoes off an interface is measured.

The interpretation of seismic data will yield subsurface velocity information, which is dependent upon the acoustic properties of the subsurface material. Various geologic materials can be categorized by their acoustic properties or velocities. Depth to geologic interfaces are calculated using the velocities obtained from a seismic investigation. The geologic information gained from a seismic investigation is then used in the hydrogeologic assessment of a groundwater pollution site and the surrounding area. The interpretation of seismic data indicates changes in lithology or stratigraphy, geologic structure, or water saturation (water table). Seismic methods are commonly used to determine the depth and structure of geologic and hydrogeologic units, to estimate hydraulic conductivity, to detect cavities or voids, to determine structure stability, to detect fractures and fault zones, and to estimate ripability. The choice of method depends upon the information needed and the nature of the study area. This decision must be made by a geophysicist who is experienced in both methods, is aware of the geologic information needed by the hydrogeologist, and is also aware of the environment of the study area. The refraction technique has been used more often than the reflection technique for hazardous waste site investigations.

### *Seismic Refraction Method*

Seismic refraction is most commonly used at sites where bedrock is less than 500 feet below the ground surface. Seismic refraction is simply the travel path of a sound wave through an upper medium and along an interface and then back to the surface. A detailed discussion of the seismic refraction technique can be found in Dobrin (1976), Telford, et. al. (1985), and Musgrave (1967).

**Advantages:** Seismic refraction surveys are more common than reflection surveys for site investigations. The velocities of each layer can be determined from refraction data, and a relatively precise estimate of the depth to different interfaces can be calculated.

Refraction surveys add to depth information in-between boreholes. Subsurface information can be obtained between boreholes at a fraction of the cost of drilling. Refraction data can be used to determine the depth to the water table or bedrock. In buried valley areas, refraction surveys map the depth to bedrock. The velocity information

obtained from a refraction survey can be related to various physical properties of the bedrock. Rock types have certain ranges of velocities and these velocities are not always unique to a particular rock type. However, they can allow a geophysicist to differentiate between certain units, such as shales and granites.

**Disadvantages:** The seismic refraction method is based on several assumptions. To successfully resolve the subsurface using the refraction method, the conditions of the geologic environment must approximate these assumptions:

- the velocities of the layers increase with depth,
- the velocity contrast between layers is sufficient to resolve the interface, and
- the geometry of the geophones in relation to the refracting layers will permit the detection of thin layers.

These conditions must be met for accurate depth information.

Collecting and interpreting seismic refraction data has several disadvantages. Data collection can be labor intensive. Also, large line lengths are needed; therefore, as a general rule, the distance from the shot, or seismic source, to the first geophone station must be at least three times the desired depth of exploration.

### *Seismic Reflection Method*

The seismic reflection method is not as commonly used on groundwater pollution site investigations as seismic refraction. In the seismic reflection method, a sound wave travels down to a geologic interface and reflects back to the surface. Reflections occur at an interface where there is a change in the acoustic properties of the subsurface material.

**Advantages:** The seismic reflection method yields information that allows the interpreter to discern between fairly discrete layers, so it is useful for mapping stratigraphy. Reflection data is usually presented in profile form, and depths to interfaces are represented as a function of time. Depth information can be obtained by converting time sections into depth measurements using velocities obtained from seismic refraction data, sonic logs, or

velocity logs. The reflection technique requires much less space than refraction surveys. The long offsets of the seismic source from the geophones, common in refraction surveys, are not required in the reflection method. In some geologic environments, reflection data can yield acceptable depth estimates.

**Disadvantages:** The major disadvantage to using reflection data is that a precise depth determination cannot be made. Velocities obtained from most reflection data are at least 10% and can be 20% of the true velocities. The interpretation of reflection data requires a qualitative approach. In addition to being more labor intensive, the acquisition of reflection data is more complex than refraction data.

The reflection method places higher requirements on the capabilities of the seismic equipment. Reflection data is commonly used in the petroleum exploration industry and requires a large amount of data processing time and lengthy data collection procedures. Although mainframe computers are often used in the reduction and analysis of large amounts of reflection data, recent advances have allowed for the use of personal computers on small reflection surveys for engineering purposes. In most cases, the data must be recorded digitally or converted to a digital format, to employ various numerical processing operations. The use of high resolution reflection seismic methods relies heavily on the geophysicist, the computer capacity, the data reduction and processing programs, resolution capabilities of the seismograph and geophones, and the ingenuity of the interpreter. Without these capabilities, reflection surveys are not recommended.

### **4.2.5 Ground Penetrating Radar**

The ground penetrating radar (GPR) method is used for a variety of civil engineering, groundwater evaluation and hazardous waste site applications. This geophysical method is the most site-specific of all geophysical techniques, providing subsurface information ranging in depth from several tens of meters to only a fraction of a meter. A basic understanding of the function of the GPR instrument, together with a knowledge of the geology and mineralogy of the site, can help determine if GPR will be successful in the site assessment. When possible, the GPR technique should be integrated with other geophysical and

geologic data to provide the most comprehensive site assessment.

The GPR method uses a transmitter that emits pulses of high-frequency electromagnetic waves into the subsurface. The transmitter is either moved slowly across the ground surface or moved at fixed station intervals. The penetrating electromagnetic waves are scattered at points of change in the complex dielectric permittivity, which is a property of the subsurface material dependent primarily upon the bulk density, clay content and water content of the subsurface (Olhoeft, 1984). The electromagnetic energy which is scattered back to the receiving antenna on the surface is recorded as a function of time.

Depth penetration is severely limited by attenuation of the transmitted electromagnetic waves into the ground. Attenuation is caused by the sum of electrical conductivity, dielectric relaxation, and geometric scattering losses in the subsurface. Generally, penetration of radar frequencies is minimized by a shallow water table, an increase in the clay content of the subsurface, and in environments where the electrical resistivity of the subsurface is less than 30 ohm-meters (Olhoeft, 1986). Ground penetrating radar works best in dry sandy soil above the water table. At applicable sites, depth resolution should be between 1 and 10 meters (Benson, 1982).

The analog plot produced by a continuously recording GPR system is analogous to a seismic reflection profile; that is, data is represented as a function of horizontal distance versus time. This representation should not be confused with a geologic cross section which represents data as a function of horizontal distance versus depth. Because very high-frequency electromagnetic waves in the megahertz range are used by radar systems, and time delays are measured in nanoseconds ( $10^{-9}$  seconds), very high resolution of the subsurface is possible using GPR. This resolution can be as high as 0.1 meter. For depth determinations, it is necessary to correlate the recorded features with actual depth measurements from boreholes or from the results of other geophysical investigations. When properly interpreted, GPR data can optimally resolve changes in soil horizons, fractures, water insoluble contaminants, geological features, man-made buried objects, and hydrologic features such as water table depth and wetting fronts.

## **Advantages**

Most GPR systems can provide a continuous display of data along a traverse which can often be interpreted qualitatively in the field. GPR is capable of providing high resolution data under favorable site conditions. The real-time capability of GPR results in a rapid turnaround, and allows the geophysicist to quickly evaluate subsurface site conditions.

## **Disadvantages**

One of the major limitations of GPR is the site-specific nature of the technique. Another limitation is the cost of site preparation which is necessary prior to the survey. Most GPR units are towed across the ground surface. Ideally, the ground surface should be flat, dry, and clear of any brush or debris. The quality of the data can be degraded by a variety of factors, such as an uneven ground surface or various cultural noise sources. For these reasons, it is mandatory that the site be visited by the project geophysicist before a GPR investigation is proposed. The geophysicist should also evaluate all stratigraphic information available, such as borehole data and information on the depth to water table in the survey area.

## **4.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE**

This section is not applicable to this SOP.

## **4.4 INTERFERENCES AND POTENTIAL PROBLEMS**

See section 4.2.1 for a discussion of limitations of the magnetic method.

See section 4.2.2 for a discussion of limitations of the electromagnetic method.

See section 4.2.3 for a discussion of limitations of the electrical resistivity method.

See section 4.2.4 for a discussion of limitations of the seismic refraction method and the seismic reflection method.

See section 4.2.5 for a discussion of limitations of the ground penetrating radar (GPR) method.

## **4.5 EQUIPMENT/APPARATUS**

### **4.5.1 Magnetics**

- GEM GSM-19G magnetometer/gradiometer, EDA OMNI IV magnetometer/gradiometer, Geonics 856AGX (with built-in datalogger) or equivalent
- magnetometer base station
- 300-foot tape measure
- non-ferrous survey stakes (wooden or plastic)

### **4.5.2 Electromagnetics**

- Geonics EM-31, EM-34 or equivalent
- Polycorder datalogger
- Dat 31Q software (data dump software)
- 300-foot tape measure
- survey stakes

### **4.5.3 Electrical Resistivity**

- DC resistivity unit (non-specific)
- 4 electrodes and appropriate cables (length dependent on depth of survey)
- 1 or 2 12-volt car batteries
- 300-foot tape measure

### **4.5.4 Seismic**

- 12- or 24-channel seismograph (Geometrics 2401 or equivalent)
- 30 10Hz to 14Hz geophones (for refraction)
- 30 50Hz or greater geophones (for reflection)
- 300-foot tape measure
- survey stakes
- sledge hammer and metal plate or explosives

### **4.5.5 Ground Penetrating Radar**

- GSSI SIR-8 or equivalent
- 80 Mhz, 100 Mhz or 300 Mhz antenna/receiver pit
- 200-foot cable
- 300-foot tape measure

## **4.6 REAGENTS**

This section is not applicable to this SOP.

## **4.7 PROCEDURES**

Refer to the manufacturer's operating manual for specific procedures relating to operation of the equipment.

## **4.8 CALCULATIONS**

Calculations vary based on the geophysical method employed. Refer to the instrument-specific users manual for specific formulae.

## **4.9 QUALITY ASSURANCE/ QUALITY CONTROL**

The following general quality assurance activities apply to the implementation of these procedures.

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

Method-specific quality assurance procedures may be found in the user's manual.

## **4.10 DATA VALIDATION**

Evaluate data as per the criteria established in section 4.9 above.

## **4.11 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

## APPENDIX A

Figures

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Figure 1: Sampling Augers

SOP #2012

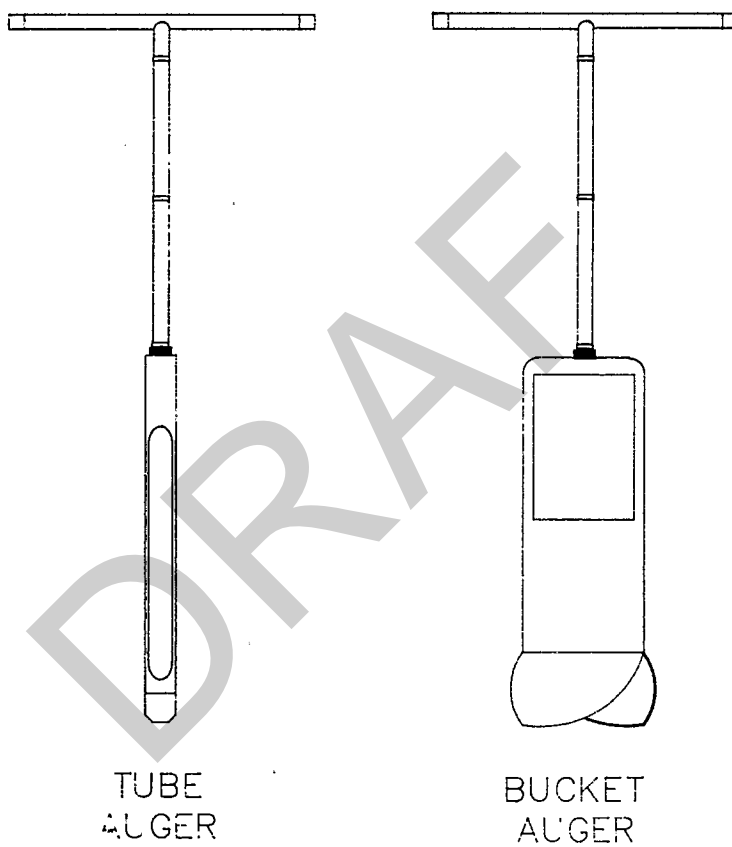


Figure 2: Sampling Trier

SOP #2012

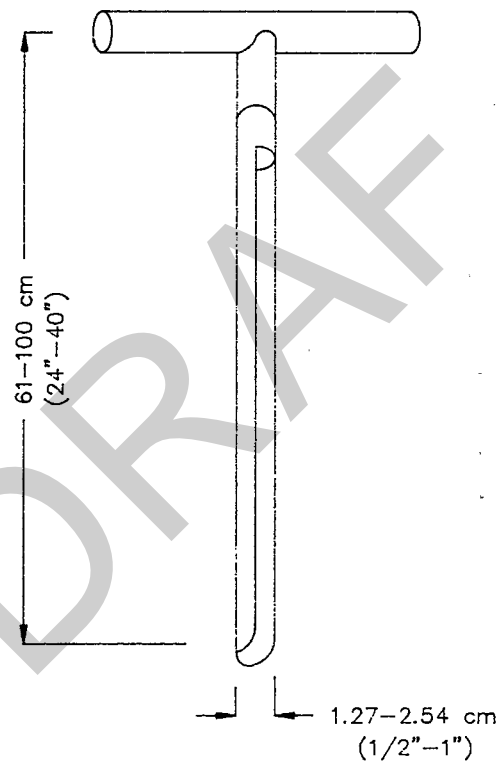
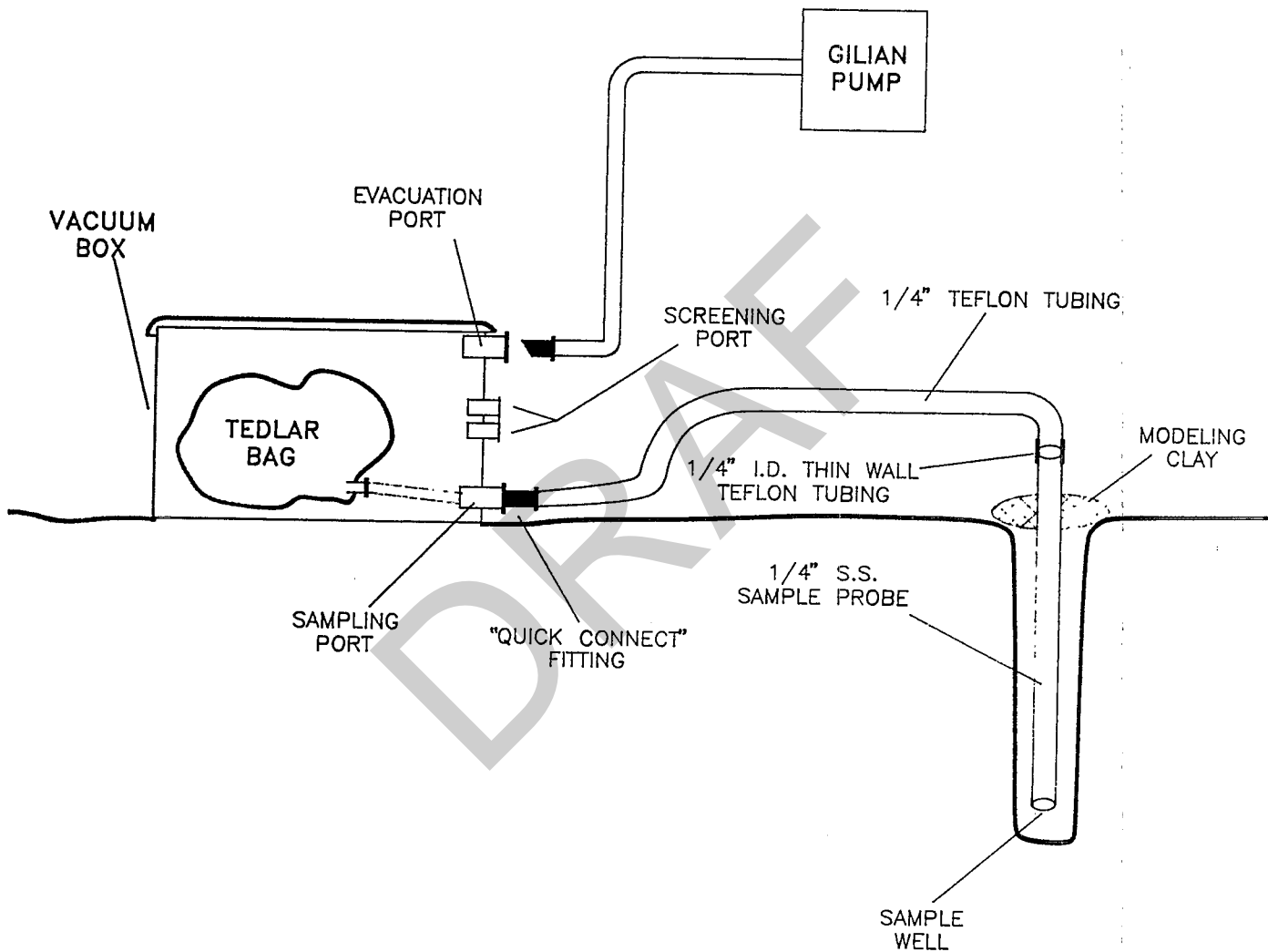




Figure 3: Sampling Train Schematic

SOP #2149



## APPENDIX B

### HNU Field Protocol

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## HNU Field Protocol SOP #2149

### Startup Procedure

1. Before attaching the probe, check the function switch on the control panel to ensure that it is in the "off" position. Attach the probe by plugging it into the interface on the top of the readout module. Use care in aligning the prongs in the probe cord with the socket: do not force it.
2. Turn the function switch to the battery check position. The needle on the meter should read within or above the green area on the scale. If not, recharge the battery. If the red indicator light comes on, the battery needs recharging.
3. Turn the function switch to any range setting. For no more than 2 to 3 seconds, look into the end of the probe to see if the lamp is on. If it is on, you will see a purple glow. Do not stare into the probe any longer than three seconds. Long term exposure to UV light can damage the eyes. Also, listen for the hum of the fan motor.
4. To zero the instrument, turn the function switch to the standby position and rotate the zero adjustment until the meter reads zero. A calibration gas is not needed since this is an electronic zero adjustment. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. Wait 15 to 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.
2. Set the function switch to the range setting for the concentration of the calibration gas.
3. Attach a regulator (HNU 101-351) to a disposable cylinder of isobutylene gas. Connect the regulator to the probe of the HNU with a piece of clean Tygon tubing. Turn the valve on the regulator to the "on" position.
4. After 15 seconds, adjust the span dial until the meter reading equals the concentration of the calibration gas used. The calibration gas is usually 100 ppm of isobutylene in zero air. The cylinders are marked in benzene equivalents for the 10.2 eV probe (approximately 55 ppm benzene equivalent) and for the 11.7 eV probe (approximately 65 ppm benzene equivalent). Be careful to unlock the span dial before adjusting it. If the span has to be set below 3.0 calibration, the lamp and ion chamber should be inspected and cleaned as appropriate. For cleaning of the 11.7 eV probe, only use an electronic-grade, oil-free freon or similar water-free, grease-free solvent.
5. Record in the field log: the instrument ID # (EPA decal or serial number if the instrument is a rental); the initial and final span settings; the date and time; concentration and type of calibration used; and the name of the person who calibrated the instrument.

### Operational Check

1. Follow the startup procedure.
2. With the instrument set on the 0-20 range, hold a solvent-based Magic Marker near the probe tip. If the meter deflects upscale, the instrument is working.

### Field Calibration Procedure

1. Follow the startup procedure and the operational check.
2. Set the function switch to the appropriate range. If the concentration of gases or vapors is unknown, set the function switch to the 0-20 ppm range. Adjust it as necessary.
3. While taking care not to permit the HNU to be exposed to excessive moisture, dirt, or contamination, monitor the work activity as specified in the site health and safety plan.
4. When the activity is completed or at the end of the day, carefully clean the outside of the HNU with a damp disposable towel to remove any

visible dirt. Return the HNU to a secure area and place on charge.

5. With the exception of the probe's inlet and exhaust, the HNU can be wrapped in clear

plastic to prevent it from becoming contaminated and to prevent water from getting inside in the event of precipitation.

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## References

### SOPs #2006, 2012, 2149

- American Standards for Testing and Materials. 1988. Standard Method for Preparing Test and Split-Barrel Sampling of Soils: Annual Book of ASTM Standards. Section 4, Volume 4.08. ASTM D1586-84.
- Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA/600/4-84/043.
- de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA/600/2-80/018.
- Gilian Instrument Corp. 1983. Instruction Manual for Hi Flow Sampler: HFS 113, HFS 113 T, HFS 113 U, HFS 113 UT.
- HNU Systems, Inc. 1975. Instruction Manual for Model PI 101 Photoionization Analyzer.
- Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA/600/4-83/020.
- National Institute for Occupational Safety and Health. October, 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. NIOSH/OSHA/USCG/EPA.
- New Jersey Department of Environmental Protection. February, 1988. Field Sampling Procedures Manual.
- Roy F. Weston, Inc. 1987. Weston Instrumentation Manual, Volume I.
- U.S. Environmental Protection Agency. December, 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods, 2nd Edition. EPA/600/4-84/076.
- U.S. Environmental Protection Agency. April 1, 1986. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual. U.S. EPA Region IV.
- U.S. Environmental Protection Agency. 1987. A Compendium of Superfund Field Operations Methods. EPA/540/P-87/001. Office of Emergency and Remedial Response. Washington, D.C. 20460.

### SOP #2159

#### Magnetics

- Breiner, S. 1973. Applications Manual for Portable Magnetometers: EG&G GeoMetrics. Sunnyvale, California.
- Fowler, J. and D. Pasicznyk. February, 1985. Magnetic Survey Methods Used in the Initial Assessment of a Waste Disposal Site: National Water Well Association Conference on Surface and Borehole Geophysics.

- Lilley, F. 1968. Optimum Direction of Survey Lines. *Geophysics* 33(2): 329-336.
- Nettleton, L.L. 1976. Elementary Gravity and Magnetism for Geologists and Seismologists: Society of Exploration Geophysicists. Monograph Series Number 1.
- Redford, M.S. 1964. Magnetic Anomalies over Thin Sheets. *Geophysics* 29(4): 532-536.
- Redford, M.S. 1964. Airborne Magnetometer Surveys for Petroleum Exploration: Aero Service Corporation. Houston, Texas.
- Vacquier, V. and others. 1951. Interpretation of Aeromagnetic Maps: Geological Society of America. Memoir Number 47.

### Electromagnetics

- Duran, P.B. 1982. The Use of Electromagnetic Conductivity Techniques in the Delineation of Groundwater Pollution Plumes: unpublished master's thesis, Boston University.
- Grant, F.S. and G.F. West. 1965. *Interpretation Theory in Applied Geophysics*. McGraw-Hill Book Company, New York, New York.
- Greenhouse, J.P., and D.D. Slaine. 1983. The Use of Reconnaissance Electromagnetic Methods to Map Contaminant Migration. *Ground Water Monitoring Review* 3(2).
- Keller, G.V. and F.C. Frischknecht. 1966. *Electrical Methods in Geophysical Prospecting*. Pergamon Press, Long Island City, New York.
- McNeill, J.D. 1980. Electromagnetic Terrain Conductivity Measurements at Low Induction Numbers. Technical Note TN-6, Geonics Limited. Mississauga, Ontario, Canada.
- McNeill, J.D. 1980. EM34-3 Survey Interpretation Techniques. Technical Note TN-8, Geonics Limited. Mississauga, Ontario, Canada.
- McNeill, J.D. 1980. Electrical Conductivity of Soils and Rocks. Technical Note TN-5, Geonics Limited. Mississauga, Ontario, Canada.
- McNeill, J.D. and M. Bosnar. 1986. Surface and Borehole Electro-Magnetic Groundwater Contamination Surveys, Pittman Lateral Transect, Nevada: Technical Note TN-22, Geonics Limited. Mississauga, Ontario, Canada.
- Stewart, M.T. 1982. Evaluation of Electromagnetic Methods for Rapid Mapping of Salt Water Interfaces in Coastal Aquifers. *Ground Water* 20.
- Telford, W.M., L.P. Geldart, R.E. Sheriff, and D.A. Keys. 1977. *Applied Geophysics*. Cambridge University Press. New York, New York.

### Electrical Resistivity

- Bisdorf, R.J. 1985. Electrical Techniques for Engineering Applications. *Bulletin of the Association of Engineering Geologists* 22(4).

- Grant, F.S. and G.F. West. 1965. *Interpretation Theory in Applied Geophysics*. McGraw-Hill Book Company, New York, New York.
- Keller, G.V. and F.C. Frischnecht. 1966. *Electrical Methods in Geophysical Prospecting*. Pergamon Press, Long Island City, New York.
- Kelly, W.E. and R.K. Frohlich. 1985. Relations between Aquifer Electrical and Hydraulic Properties. *Ground Water* 23:2.
- Stollar, R. and P. Roux. 1975. Earth Resistivity Surveys -- A Method for Defining Groundwater Contamination. *Ground Water* 13.
- Sumner, J.S. 1976. *Principles of Induced Polarization for Geophysical Exploration*. Elsevier Scientific Publishing, New York, New York.
- Telford, W.M., L.P. Geldart, R.E. Sheriff, and D.A. Keys. 1977. *Applied Geophysics*. Cambridge University Press, New York, New York.
- Urish, D.W. 1983. The Practical Application of Surface Electrical Resistivity to Detection of Ground Water Pollution. *Ground Water* 21.
- Van Nostrand, R.E., and L.K. Cook. 1966. Interpretation of Resistivity Data: U.S. Geological Survey Professional Paper 499, Washington, D.C.
- Zohdy, A.A.R. 1975. Automatic Interpretation of Schlumberger Sounding Curves Using Modified Dar Zarrouk Functions. *U.S. Geological Survey Bulletin* 1313-E, Denver, Colorado.

#### Seismic

- Coffeen, J.A. 1978. *Seismic Exploration Fundamentals*. PennWell Publishing, Tulsa, Oklahoma.
- Dobrin, M.B. 1976. *Introduction to Geophysical Prospecting*, 3rd ed. McGraw-Hill, New York, New York.
- Griffiths, D.H. and R.E. King. 1981. *Applied Geophysics for Geologists and Engineers*. Second edition. Pergamon Press, Oxford, England.
- Miller, R.D., S.E. Pullan, J.S. Waldner, and F.P. Haeni. 1986. Field Comparison of Shallow Seismic Sources. *Geophysics* 51(11): 2067-92.
- Musgrave, A.W. 1967. *Seismic Refraction Prospecting*. The Society of Exploration Geophysicists. Tulsa, Oklahoma.
- Telford, W.M., L.P. Geldart, R.E. Sheriff, and D.A. Keys. 1985. *Applied Geophysics*. Cambridge University Press, Cambridge, England.

#### Ground Penetrating Radar

- Benson, R.C., R.A. Glaccum, and M.R. Noel. 1982. *Geophysical Techniques for Sensing Buried Wastes and Waste Migrations*. Technos Inc. Miami, Florida. 236 pp.

Olehoft, G.R. 1984. Applications and Limitations of Ground Penetrating Radar: Expanded Abstracts, Society of Exploration Geophysicists. 54th Annual Meeting: December 2-6, 1984. Atlanta, Georgia. 147-148.

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# COMPENDIUM OF ERT WASTE SAMPLING PROCEDURES

Sampling Equipment Decontamination

Drum Sampling

Tank Sampling

Chip, Wipe, and Sweep Sampling

Waste Pile Sampling

Interim Final

Environmental Response Team  
Emergency Response Division

Office of Emergency and Remedial Response  
U.S. Environmental Protection Agency  
Washington, DC 20460



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Each Standard Operating Procedure in this compendium contains a discussion on quality assurance/quality control (QA/QC). For more information on QA/QC objectives and requirements, refer to the *Quality Assurance/Quality Control Guidance for Removal Activities*, OSWER directive 9360.4-01, EPA/540/G-90/004.

Questions, comments, and recommendations are welcomed regarding the Compendium of ERT Waste Sampling Procedures. Send remarks to:

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## 1.0 SAMPLING EQUIPMENT DECONTAMINATION: SOP #2006

### 1.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures at a hazardous waste site. Preventing or minimizing cross-contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel.

Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

### 1.2 METHOD SUMMARY

Contaminants can be physically removed from equipment, or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and non-abrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water cleaning, followed by a wash/rinse process using appropriate cleaning solutions. Use of a solvent rinse is required when organic contamination is present.

### 1.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

### 1.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment

provided that it has been verified by laboratory analysis to be analyte free.

- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions.
- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.
- The site work plan must address disposal of the spent decontamination solutions.
- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

- Stress work practices that minimize contact with hazardous substances.
- Use remote sampling, handling, and container-opening techniques when appropriate.
- Cover monitoring and sampling equipment with protective material to minimize contamination.
- Use disposable outer garments and disposable sampling equipment when appropriate.

### 1.5 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water



- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

## 1.6 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions and solvents. In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid<sup>(1)</sup>
- acetone (pesticide grade)<sup>(2)</sup>
- hexane (pesticide grade)<sup>(2)</sup>
- methanol

<sup>(1)</sup> Only if sample is to be analyzed for trace metals.

<sup>(2)</sup> Only if sample is to be analyzed for organics.

## 1.7 PROCEDURES

As part of the health and safety plan, develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- the number, location, and layout of decontamination stations
- which decontamination apparatus is needed
- the appropriate decontamination methods
- methods for disposal of contaminated clothing, apparatus, and solutions

### 1.7.1 Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or do both.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

### *Abrasive Cleaning Methods*

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available:

- **Mechanical:** Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.
- **Air Blasting:** Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs or auger bits. The equipment used in air blast cleaning employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages: it is unable to control the amount of material removed, it can aerate contaminants, and it generates large amounts of waste.
- **Wet Blasting:** Wet blast cleaning, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. This method generates a large amount of waste.

### *Non-Abrasive Cleaning Methods*

Non-abrasive cleaning methods work by forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods. The following non-abrasive methods are available:

- **High-Pressure Water:** This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) which relates to flow rates of 20 to 140 liters per minute.
- **Ultra-High-Pressure Water:** This system produces a pressurized water jet (from 1,000 to 4,000 atm). The ultra-high-pressure spray removes tightly-adhered surface film. The water velocity ranges from 500 m/sec (1,000 atm) to 900 m/sec (4,000 atm). Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

### *Disinfection/Rinse Methods*

- **Disinfection:** Disinfectants are a practical means of inactivating infectious agents.
- **Sterilization:** Standard sterilization methods involve heating the equipment. Sterilization is impractical for large equipment.
- **Rinsing:** Rinsing removes contaminants through dilution, physical attraction, and solubilization.

### **1.7.2 Field Sampling Equipment Cleaning Procedures**

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Where applicable, follow physical removal procedures specified in section 1.7.1.
2. Wash equipment with a non-phosphate detergent solution.
3. Rinse with tap water.
4. Rinse with distilled/deionized water.
5. Rinse with 10% nitric acid if the sample will be analyzed for trace organics.

6. Rinse with distilled/deionized water.
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics.
8. Air dry the equipment completely.
9. Rinse again with distilled/deionized water.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the contaminants of concern at the site.

Table 1 on page 4 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air dried and rinsed with distilled/deionized water.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

### **1.8 CALCULATIONS**

This section is not applicable to this SOP.

### **1.9 QUALITY ASSURANCE/ QUALITY CONTROL**

One type of quality control sample specific to the field decontamination process is the rinsate blank. The rinsate blank provides information on the effectiveness of the decontamination process employed in the field. When used in conjunction with field blanks and trip blanks, a rinsate blank can detect contamination during sample handling, storage and sample transportation to the laboratory.

Table 1: Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS
Water	<ul style="list-style-type: none"> <li>• Low-chain hydrocarbons</li> <li>• Inorganic compounds</li> <li>• Salts</li> <li>• Some organic acids and other polar compounds</li> </ul>
Dilute Acids	<ul style="list-style-type: none"> <li>• Basic (caustic) compounds</li> <li>• Amines</li> <li>• Hydrazines</li> </ul>
Dilute Bases -- for example, detergent and soap	<ul style="list-style-type: none"> <li>• Metals</li> <li>• Acidic compounds</li> <li>• Phenol</li> <li>• Thiols</li> <li>• Some nitro and sulfonic compounds</li> </ul>
Organic Solvents <sup>(1)</sup> - for example, alcohols, ethers, ketones, aromatics, straight-chain alkanes (e.g., hexane), and common petroleum products (e.g., fuel, oil, kerosene)	<ul style="list-style-type: none"> <li>• Nonpolar compounds (e.g., some organic compounds)</li> </ul>

<sup>(1)</sup> - WARNING: Some organic solvents can permeate and/or degrade protective clothing.

A rinsate blank consists of a sample of analyte-free (i.e, deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container.

Rinsate blanks should be run for all parameters of interest at a rate of 1 per 20 for each parameter, even if samples are not shipped that day. Rinsate blanks are not required if dedicated sampling equipment is used.

## 1.10 DATA VALIDATION

This section is not applicable to this SOP.

## 1.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect

health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment; some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

The decontamination solutions and solvents must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods pose a direct health hazard, measures should be taken to protect personnel or the methods should be modified to eliminate the hazard.

## 2.0 DRUM SAMPLING: SOP #2009

### 2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide technical guidance on safe and cost-effective response actions at hazardous waste sites containing drums with unknown contents. Container contents are sampled and characterized for disposal, bulking, recycling, grouping, and/or classification purposes.

### 2.2 METHOD SUMMARY

Prior to sampling, drums must be inventoried, staged, and opened. An inventory entails recording visual qualities of each drum and any characteristics pertinent to the contents' classification. Staging involves the organization, and sometimes consolidation of drums which have similar wastes or characteristics. Opening of closed drums can be performed manually or remotely. Remote drum opening is recommended for worker safety. The most widely used method of sampling a drum involves the use of a glass thief. This method is quick, simple, relatively inexpensive, and requires no decontamination.

### 2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected from drums are considered waste samples. No preservatives should be added since there is a potential reaction of the sample with the preservative. Samples should, however, be cooled to 4°C and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.

Sample bottles for collection of waste liquids, sludges, or solids are typically wide-mouth amber jars with Teflon-lined screw caps. Actual volume required for analysis should be determined in conjunction with the laboratory performing the analysis.

Follow these waste sample handling procedures:

1. Place sample container in two Ziploc plastic bags.

2. Place each bagged container in a 1-gallon covered can containing absorbent packing material. Place the lid on the can.
3. Mark the sample identification number on the outside of the can.
4. Place the marked cans in a cooler, and fill remaining space with absorbent packing material.
5. Fill out chain of custody form for each cooler, place in plastic, and affix to inside lid of cooler.
6. Secure and custody seal the lid of cooler.
7. Arrange for the appropriate transportation mode consistent with the type of hazardous waste involved.

### 2.4 INTERFERENCES AND POTENTIAL PROBLEMS

The practice of tapping drums to determine their contents is neither safe nor effective and should not be used if the drums are visually overpressurized or if shock-sensitive materials are suspected. A laser thermometer may be used instead.

Drums that have been overpressurized, to the extent that the head is swollen several inches above the level of the chime, should not be moved. A number of devices have been developed for venting critically swollen drums. One method that has proven to be effective is a tube and spear device. A light aluminum tube (3 meters long) is positioned at the vapor space of the drum. A rigid, hooking device attached to the tube goes over the chime and holds the tube securely in place. The spear is inserted in the tube and positioned against the drum wall. A sharp blow on the end of the spear drives the sharpened tip through the drum and the gas vents along the grooves. The venting should be done from behind a wall or barricade. This device can be cheaply and easily designed and constructed where needed. Once the pressure has been relieved, the bung can be removed and the drum sampled.

## 2.5 EQUIPMENT/APPARATUS

The following are standard materials and equipment required for sampling:

- personal protection equipment
- wide-mouth glass jars with Teflon cap liner, approximately 500 mL volume
- uniquely numbered sample identification labels with corresponding data sheets
- 1-gallon covered cans half-filled with absorbent (vermiculite)
- chain of custody forms
- decontamination materials
- glass thief tubes or Composite Liquid Waste Samplers (COLIWASA)
- laser thermometer
- drum opening devices

Drum opening devices include the following:

### 2.5.1 Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium, non-sparking alloy formulated to reduce the likelihood of sparks. The use of a non-sparking bung wrench does not completely eliminate the possibility of a spark being produced. (See Figure 1, Appendix B.)

### 2.5.2 Drum Deheader

When a bung is not removable with a bung wrench, a drum can be opened manually by using a drum deheader. This tool is constructed of forged steel with an alloy steel blade and is designed to cut the lid of a drum off or part way off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums. Drums with removable heads must be opened by other means. (See Figure 2, Appendix B.)

### 2.5.3 Hand Pick, Pickaxe, and Hand Spike

These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most

commonly used are commercially available; whereas the spikes are generally uniquely fabricated 4-foot long poles with a pointed end. (See Figure 3, Appendix B.)

### 2.5.4 Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personal exposure. (See Figure 4, Appendix B.)

### 2.5.5 Hydraulic Drum Opener

Another remote method for opening drums is with remotely operated hydraulic devices. One such device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump which pressurizes soil through a length of hydraulic line. (See Figure 5, Appendix B.)

### 2.5.6 Pneumatic Devices

A pneumatic bung remover consists of a compressed air supply that is controlled by a heavy-duty, two-stage regulator. A high-pressure air line of desired length delivers compressed air to a pneumatic drill, which is adapted to turn a bung fitting selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device. (See Figure 6, Appendix B.)

## 2.6 REAGENTS

Reagents are not typically required for preserving drum samples. However, reagents are used for decontaminating sampling equipment. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

## 2.7 PROCEDURES

### 2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

### 2.7.2 Drum Inspection

Appropriate procedures for handling drums depend on the contents. Thus, prior to any handling, drums should be visually inspected to gain as much information as possible about their contents. Those in charge of inspections should be on the look-out for:

- drum condition, corrosion, rust, and leaking contents
- symbols, words, or other markings on the drum indicating hazards (i.e., explosive, radioactive, toxic, flammable)
- signs that the drum is under pressure
- shock sensitivity

Monitor around the drums with radiation instruments, organic vapor monitors (OVA) and combustible gas indicators (CGI).

Classify the drums into categories, for instance:

- radioactive
- leaking/deteriorating
- bulging
- drums containing lab packs
- explosive/shock sensitive

All personnel should assume that unmarked drums contain hazardous materials until their contents have been categorized, and that labels on drums may not accurately describe their contents.

If it is presumed that there are buried drums on-site, geophysical investigation techniques such as magnetometry, ground penetrating radar, and metal detection can be employed in an attempt to determine depth and location of the drums. See ERT SOP #2159, General Surface Geophysics.

### 2.7.3 Drum Staging

Prior to sampling, the drums should be staged to allow easy access. Ideally, the staging area should be located just far enough from the drum opening area to prevent a chain reaction if one drum should explode or catch fire when opened.

While staging, physically separate the drums into the following categories: those containing liquids, those containing solids, lab packs, or gas cylinders, and those which are empty. This is done because the strategy for sampling and handling drums/containers in each of these categories will be different. This may be achieved by:

- Visual inspection of the drum and its labels, codes, etc. Solids and sludges are typically disposed of in open-top drums. Closed-head drums with a bung opening generally contain liquid.
- Visual inspection of the contents of the drum during sampling followed by restaging, if needed.

Once a drum has been excavated and any immediate hazard has been eliminated by overpacking or transferring the drum's contents, affix a numbered tag to the drum and transfer it to a staging area. Color-coded tags, labels, or bands should be used to mark similar waste types. Record a description of each drum, its condition, any unusual markings, and the location where it was buried or stored, on a drum data sheet (Appendix A). This data sheet becomes the principal

recordkeeping tool for tracking the drum onsite.

Where there is good reason to suspect that some drums contain radioactive, explosive, and shock-sensitive materials, these drums should be staged in a separate, isolated area. Placement of explosives and shock-sensitive materials in diked and fenced areas will minimize the hazard and the adverse effects of any premature detonation of explosives.

Where space allows, the drum opening area should be physically separated from the drum removal and drum staging operations. Drums are moved from the staging area to the drum opening area one at a time using forklift trucks equipped with drum grabbers or a barrel grapple. In a large-scale drum handling operation, drums may be conveyed to the drum opening area using a roller conveyor.

## 2.7.4 Drum Opening

There are three basic techniques available for opening drums at hazardous waste sites:

- Manual opening with non-sparking bung wrenches,
- Drum deheading, and
- Remote drum puncturing or bung removal.

The choice of drum opening techniques and accessories depends on the number of drums to be opened, their waste contents, and physical condition. Remote drum opening equipment should always be considered in order to protect worker safety. Under OSHA 1910.120, manual drum opening with bung wrenches or deheaders should be performed only with structurally sound drums having contents that are known to be (1) not shock sensitive, (2) non-reactive, (3) non-explosive, and (4) non-flammable.

### *Manual Drum Opening with a Bung Wrench*

Manual drum opening with bung wrenches (Figure 1, Appendix B) should not be performed unless the drums are structurally sound (no evidence of bulging or deformation) and their contents are known to be non-explosive. If opening the drum with bung wrenches is deemed reasonably cost-effective and safe, then follow these procedures to minimize the hazard:

1. Fully outfit field personnel with protective gear.
2. Position drum upright with the bung up, or, for drums with bungs on the side, lay the drum on its side with the bung plug up.
3. Wrench the bung with a slow, steady pulling motion across the drum. If the length of the bung wrench handle provides inadequate leverage for unscrewing the plug, attach a "cheater bar" to the handle to improve leverage.

### *Manual Drum Opening with a Drum Deheader*

Drums are opened with a drum deheader (Figure 2, Appendix B) by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will cut off the entire top. If the top chime of a drum has been damaged or badly dented, it may not be possible to cut off the entire top. Since there is always the possibility that a drum may be under pressure, make the initial cut very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to use a remote method to puncture the drum prior to using the deheader.

Self-propelled drum openers which are either electrically or pneumatically driven can be used for quicker and more efficient deheading.

### *Manual Drum Opening with a Hand Pick, Pickaxe, or Spike*

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, the drum can be opened for sampling by using a hand pick, pickaxe, or spike (Figure 3, Appendix B). Often the drum lid or head must be hit with a great deal of force in order to penetrate it. The potential for splash or spraying is greater than with other opening methods and, therefore, this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums cannot be opened slowly with these tools, spray from drums is common requiring appropriate safety measures. Decontaminate the pick or spike after each drum is opened to avoid cross-contamination and/or adverse chemical reaction from incompatible materials.

### *Remote Drum Opening with a Backhoe Spike*

Remotely operated drum opening tools are the safest available means of drum opening. Remote drum opening is slow, but is much safer compared to manual methods of opening.

Drums should be "staged" or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike (Figure 4, Appendix B) should be decontaminated after each drum is opened to prevent cross-contamination. Even though some splash or spray may occur when this method is used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the required level of personal protection gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system.

### *Remote Drum Opening with Hydraulic Devices*

A piercing device with a metal point is attached to the end of a hydraulic line and is pushed into the drum by hydraulic pressure (Figure 5, Appendix B). The piercing device can be attached so that the sampling hole can be made on either the side or the head of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place if desired and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

### *Remote Drum Opening with Pneumatic Devices*

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely (Figure 6, Appendix B).

## **2.7.5 Drum Sampling**

After the drum has been opened, monitor headspace gases using an explosimeter and organic vapor analyzer. In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, take a sample that represents the entire depth of the vessel.

When sampling a previously sealed vessel, check for the presence of a bottom sludge. This is easily accomplished by measuring the depth to the apparent bottom, then comparing it to the known interior depth.

### *Glass Thief Sampler*

The most widely used implement for sampling is a glass tube commonly referred to as a glass thief (Figure 7, Appendix B). This tool is simple, cost effective, quick, and collects a sample without having to decontaminate. Glass thieves are typically 6mm to 16mm I.D. and 48 inches long.

Procedures for using a glass thief are as follows:

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the drum or until a solid layer is encountered. About one foot of tubing should extend above the drum.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Cap the top of the sampling tube with a tapered stopper or thumb, ensuring liquid does not come into contact with stopper.
5. Carefully remove the capped tube from the drum and insert the uncapped end in the sample container.
6. Release stopper and allow the glass thief to drain until the container is approximately 2/3 full.
7. Remove tube from the sample container, break it into pieces and place the pieces in the drum.



8. Cap the sample container tightly and place prelabeled sample container in a carrier.
9. Replace the bung or place plastic over the drum.
10. Log all samples in the site logbook and on field data sheets.
11. Package samples and complete necessary paperwork.
12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

In many instances a drum containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and then a gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by the use of a stainless steel lab spoon.

It should be noted that in some instances disposal of the tube by breaking it into the drum may interfere with eventual plans for the removal of its contents. This practice should be cleared with the project officer or other disposal techniques evaluated.

### *COLIWASA Sampler*

Some equipment is designed to collect a sample from the full depth of a drum and maintain it in the transfer tube until delivery to the sample bottle. These designs include primarily the Composite Liquid Waste Sampler (COLIWASA) and modifications thereof. The COLIWASA (Figure 8, Appendix B) is a much cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. One configuration consists of a 152 cm by 4 cm I.D. section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end.

Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. One model of the COLIWASA is shown in Appendix B; however, the design can be modified and/or adapted somewhat to meet the needs of the sampler.

The major drawbacks associated with using a COLIWASA concern decontamination and costs. The sampler is difficult, if not impossible to decontaminate in the field and its high cost in relation to alternative procedures (glass tubes) make it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Follow these procedures for using the COLIWASA:

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
2. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.
3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.
4. Slowly withdraw the sample from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.
5. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
6. Cap the sample container tightly and place prelabeled sample container in a carrier.
7. Replace the bung or place plastic over the drum.
8. Log all samples in the site logbook and on field data sheets.

9. Package samples and complete necessary paperwork.

10. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

## **2.8 CALCULATIONS**

This section is not applicable to this SOP.

## **2.9 QUALITY ASSURANCE/ QUALITY CONTROL**

The following general quality assurance procedures apply:

- Document all data on standard chain of custody forms, field data sheets, or within site logbooks.
- Operate all instrumentation in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **2.10 DATA VALIDATION**

This section is not applicable to this SOP.

## **2.11 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

The opening of closed containers is one of the most hazardous site activities. Maximum efforts should be made to ensure the safety of the sampling team. Proper protective equipment and a general awareness of the possible dangers will minimize the risk inherent in sampling operations. Employing proper drum-opening techniques and equipment will also safeguard personnel. Use remote sampling equipment whenever feasible.

## 3.0 TANK SAMPLING: SOP #2010

### 3.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide protocols for sampling tanks and other confined spaces from outside the vessel.

### 3.2 METHOD SUMMARY

The safe collection of a representative sample should be the criterion for selecting sample locations. A representative sample can be collected using techniques or equipment that are designed for obtaining liquids or sludges from various depths. The structure and characteristics of storage tanks present problems with collection of samples from more than one location; therefore, the selection of sampling devices is an important consideration.

Depending on the type of vessel and characteristics of the material to be sampled, one can choose a bailer, glass thief, bacon bomb sampler, sludge judge, COLIWASA, or subsurface grab sampler to collect the sample. For depths of less than 5-feet, a bailer, COLIWASA, or sludge judge can be used. A sludge judge, subsurface grab sampler, bailer, or bacon bomb sampler can be used for depths greater than 5-feet. A sludge judge or bacon bomb can be used to determine if the tank consists of various strata.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with an LEL reading greater than 25%.

All personnel involved in tank sampling should be advised as to the hazards associated with working in unfavorable conditions.

### 3.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected from tanks are considered waste samples and, as such, addition of preservatives is not required due to the potential reaction of the sample with the preservative. Samples should,

however, be cooled to 4°C and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.

Sample bottles for collection of waste liquids, sludges, or solids are typically wide-mouth amber jars with Teflon-lined screw caps. Actual volume required for analysis should be determined in conjunction with the laboratory performing the analysis.

Waste sample handling procedures should be as follows:

1. Place sample container in two Ziploc plastic bags.
2. Place each bagged container in a 1-gallon covered can containing absorbent packing material. Place the lid on the can.
3. Mark the sample identification number on the outside of the can.
4. Place the marked cans in a cooler, and fill remaining space with absorbent packing material.
5. Fill out a chain of custody form for each cooler, place it in plastic, and affix it to the inside lid of the cooler.
6. Secure and custody seal the lid of cooler.
7. Arrange for the transportation appropriate for the type of hazardous waste involved.

### 3.4 INTERFERENCES AND POTENTIAL PROBLEMS

Sampling a storage tank requires a great deal of manual dexterity, often requiring the sampler to climb to the top of the tank upon a narrow vertical or spiral stairway or ladder while wearing protective clothing and carrying sampling equipment.

Before climbing onto the vessel, perform a structural survey of the tank to ensure the sampler's

safety and accessibility prior to initiating field activities.

As in all opening of containers, take extreme caution to avoid ignition or combustion of volatile contents. All tools used must be constructed of a non-sparking material and electronic instruments must be intrinsically safe.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with an LEL reading greater than 25%.

### 3.5 EQUIPMENT/APPARATUS

Storage tank materials include liquids, sludges, still bottoms, and solids of various structures. The type of sampling equipment chosen should be compatible with the waste. Samplers commonly used for tanks include: the bacon bomb sampler, the sludge judge, glass thief, bailer, COLIWASA, and subsurface grab sampler.

- sampling plan
- safety equipment
- tape measure
- weighted tape line or equivalent
- camera/film
- stainless steel bucket or bowl
- sample containers
- Ziploc plastic bags
- logbook
- labels
- field data sheets
- chain of custody forms
- flashlight (explosion proof)
- coolers
- ice
- decontamination supplies
- bacon bomb sampler
- sludge judge
- glass thief
- bailer
- COLIWASA
- subsurface grab sampler
- water/oil level indicator
- OVA (organic vapor analyzer or equivalent)
- explosimeter/oxygen meter
- high volume blower

### 3.6 REAGENTS

Reagents are not typically required for the preservation of waste samples. However, reagents will be utilized for decontamination of equipment. Decontamination solutions required are specified in ERT SOP #2006, Sampling Equipment Decontamination.

### 3.7 PROCEDURES

#### 3.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Identify and mark all sampling locations.

#### 3.7.2 Preliminary Inspection

1. Inspect the external structural characteristics of each tank and record in the site logbook. Potential sampling points should be evaluated for safety, accessibility, and sample quality.
2. Prior to opening a tank for internal inspection, the tank sampling team should:
  - Review safety procedures and emergency contingency plans with the Safety Officer,
  - Ensure that the tank is properly grounded,
  - Remove all sources of ignition from the immediate area.
3. Each tank should be mounted using appropriate means. Remove manway covers using non-sparking tools.

4. Collect air quality measurements for each potential sample location using an explosimeter/oxygen meter for a lower explosive limit (LEL/O<sub>2</sub>) reading and an OVA/HNU for an organic vapor concentration. Both readings should be taken from the tank headspace, above the sampling port, and in the breathing zone.
5. Prior to sampling, the tank headspace should be cleared of any toxic or explosive vapor concentration using a high volume blower. No work should start if LEL readings exceed 25%. At 10% LEL, work can continue but with extreme caution.
5. Measure the outside diameter of the tank and determine the volume of wastes using the depth measurements. (See Appendix C for calculations.)
6. Sludges can be collected using a bacon bomb sampler, glass thief, or sludge judge.
7. Record all information on the sample data sheet or site logbook. Label the container with the appropriate sample tag.
8. Decontaminate sampling equipment as per ERT SOP #2006, Sampling Equipment Decontamination.

### 3.7.3 Sampling Procedures

1. Determine the depth of any and all liquid-solid interface, and depth of sludge using a weighted tape measure, probe line, sludge judge, or equivalent.
2. Collect liquid samples from 1-foot below the surface, from mid-depth of liquid, and from 1-foot above the bottom sludge layer. This can be accomplished with a subsurface grab sampler or bacon bomb. For liquids less than 5-feet in depth, use a glass thief or COLIWASA to collect the sample.

If sampling storage tanks, vacuum trucks, or process vessels, collect at least one sample from each compartment in the tank. Samples should always be collected through an opened hatch at the top of the tank. Valves near the bottom should not be used, because of their questionable or unknown integrity. If such a valve cannot be closed once opened, the entire tank contents may be lost to the ground surface. Also, individual strata cannot be sampled separately through a valve near the bottom.

3. Compare the three samples for visual phase differences. If phase differences appear, systematic iterative sampling should be performed. By halving the distance between two discrete sampling points, one can determine the depth of the phase change.
4. If another sampling port is available, sample as above to verify the phase information.

### 3.7.4 Sampling Devices

#### *Bacon Bomb Sampler*

The bacon bomb sampler (Figure 9, Appendix B) is designed to collect material from various levels within a storage tank. It consists of a cylindrical body, usually made of chrome-plated brass and bronze with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger opens and closes the valve. A line is attached to the removable top cover which has a locking mechanism to keep the plunger closed after sampling.

1. Attach the sample line and the plunger line to the sampler.
2. Measure and then mark the sampling line at the desired depth.
3. Gradually lower the bacon bomb sampler by the sample line until the desired level is reached.
4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill before releasing the plunger line to seal off the sampler.
5. Retrieve the sampler by the sample line. Be careful not to pull up on the plunger line and thereby prevent accidental opening of the bottom valve.
6. Rinse or wipe off the exterior of the sampler body.

7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.
8. Cap the sample container tightly and place prelabeled sample container in a carrier.
9. Replace the bung or place plastic over the tank.
10. Log all samples in the site logbook and on field data sheets and label all samples.
11. Package samples and complete necessary paperwork.
12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

### *Sludge Judge*

A sludge judge (Figure 10, Appendix B) is used for obtaining an accurate reading of solids which can settle, in any liquid, to any depth. The sampler consists of 3/4-inch plastic pipe in 5-foot sections, marked at 1-foot increments, with screw-style fittings. The top section includes a nylon line for raising the sampler.

1. Lower the sludge judge to the bottom of the tank.
2. When the bottom has been reached, and the pipe has filled to surface level, tug slightly on the rope as you begin to raise the unit. This will seat the check valve, trapping the column of material.
3. When the unit has been raised clear of the tank liquid, the amount of sludge in the sample can be read using the 1-foot increments marked on the pipe sections.
4. By touching the pin extending from the bottom section against a hard surface, the material is released from the unit.
5. Cap the sample container tightly and place prelabeled sample container in a carrier.
6. Replace the bung or place plastic over the tank.
7. Log all samples in the site logbook and on field data sheets and label all samples.

8. Package samples and complete necessary paperwork.
9. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

### *Subsurface Grab Sampler*

Subsurface grab samplers (Figure 11, Appendix B) are designed to collect samples of liquids at various depths. The sampler is usually constructed of aluminum or stainless steel tubing with a polypropylene or Teflon head that attaches to a 1-liter sample container.

1. Screw the sample bottle onto the sampling head.
2. Lower the sampler to the desired depth.
3. Pull the ring at the top which opens the spring-loaded plunger in the head assembly.
4. When the bottle is full, release the ring, lift sampler, and remove sample bottle.
5. Cap the sample container tightly and place prelabeled sample container in a carrier.
6. Replace the bung or place plastic over the tank.
7. Log all samples in the site logbook and on field data sheets and label all samples.
8. Package samples and complete necessary paperwork.
9. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

### *Glass Thief*

The most widely used implement for sampling is a glass tube commonly referred to as a glass thief (Figure 7, Appendix B). This tool is simple, cost effective, quick, and collects a sample without having to decontaminate. Glass thieves are typically 6mm to 16mm I.D. and 48 inches long.

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the

tank or until a solid layer is encountered. About 1 foot of tubing should extend above the tank.

3. Allow the waste in the tank to reach its natural level in the tube.
4. Cap the top of the sampling tube with a tapered stopper or thumb, ensuring liquid does not come into contact with stopper.
5. Carefully remove the capped tube from the tank and insert the uncapped end in the sample container. Do not spill liquid on the outside of the sample container.
6. Release stopper and allow the glass thief to drain until the container is approximately 2/3 full.
7. Remove tube from the sample container, break it into pieces and place the pieces in the tank.
8. Cap the sample container tightly and place prelabeled sample container in a carrier.
9. Replace the bung or place plastic over the tank.
10. Log all samples in the site logbook and on field data sheets and label all samples.
11. Package samples and complete necessary paperwork.
12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

In many instances a tank containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and then a gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by the use of a stainless steel lab spoon.

### **Bailer**

The positive-displacement volatile sampling bailer (manufactured by GPI or equivalent) (Figure 12, Appendix B) is perhaps the most appropriate for collecting water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less

desirable, but may be mandated by cost and site conditions. Generally, bailers can provide an acceptable sample, providing that the sampling personnel use extra care in the collection process.

1. Make sure clean plastic sheeting surrounds the tank.
2. Attach a line to the bailer.
3. Lower the bailer slowly and gently into the tank so as not to splash the bailer into the tank contents.
4. Allow the bailer to fill completely and retrieve the bailer from the tank.
5. Begin slowly pouring from the bailer.
6. Cap the sample container tightly and place prelabeled sample container in a carrier.
7. Replace the bung or place plastic over the tank.
8. Log all samples in the site logbook and on field data sheets and label all samples.
9. Package samples and complete necessary paperwork.
10. Transport sample to decontamination zone to prepare it for transport to an analytical laboratory.

### **COLIWASA**

Some equipment is designed to collect a sample from the full depth of a tank and maintain it in the transfer tube until delivery to the sample bottle. These designs include primarily the Composite Liquid Waste Sampler (COLIWASA) (Figure 8, Appendix B) and modifications thereof. The COLIWASA is a much cited sampler designed to permit representative sampling of multiphase wastes from tanks and other containerized wastes. One configuration consists of a 152 cm by 4 cm I.D. section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper.

The major drawbacks associated with using a COLIWASA concern decontamination and costs. The sampler is difficult if not impossible to decontaminate in the field and its high cost in relation to alternative procedures (glass tubes) make it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
2. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.
3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.
4. Slowly withdraw the sample from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.
5. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
6. Cap the sample container tightly and place prelabeled sample container in a carrier.
7. Replace the bung or place plastic over the tank.
8. Log all samples in the site logbook and on field data sheets and label all samples.
9. Package samples and complete necessary paperwork.
10. Transport sample to decontamination zone to

prepare it for transport to the analytical laboratory.

### 3.8 CALCULATIONS

Refer to Appendix C for calculations to determine tank volumes.

### 3.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

### 3.10 DATA VALIDATION

This section is not applicable to this SOP.

### 3.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures. More specifically, the hazards associated with tank sampling may cause bodily injury, illness, or death to the worker. Failure to recognize potential hazards of waste containers is the cause of most accidents. It should be assumed that the most unfavorable conditions exist, and that the danger of explosion and poisoning will be present. Hazards specific to tank sampling are:

- Hazardous atmospheres can be flammable, toxic, asphyxiating, or corrosive.
- If activating electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated



to prevent inadvertent activation while workers are occupied.

- Communication is of utmost importance between the sampling worker and the standby person to prevent distress or injury going unnoticed. The Illuminating Engineers Society Lighting Handbook requires suitable illumination to provide sufficient visibility for work.
- Noise reverberation may disrupt verbal communication with standby personnel.

- Tank vibration may affect multiple body parts and organs of the sampler depending on vibration characteristics.
- General hazards include falling scaffolding, surface residues (which could cause electrical shock, incompatible material reactions, slips, or falls), and structural objects (including baffles/trays in horizontal/vertical tanks, and overhead structures).

DRAFT

## 4.0 CHIP, WIPE, AND SWEEP SAMPLING: SOP #2011

### 4.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potential surficial contamination.

This method of sampling is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., PCB, PCDD, PCDF, metals, cyanide, etc.) Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is 1 square foot. However, based upon sampling location, the area may need modification due to area configuration.

### 4.2 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean, autoclaved aluminum foil until ready for use. To collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. Sampling personnel wear a new pair of surgical gloves to open a sterile gauze pad, and then soak it with solvent. The solvent used is dependent on the surface being sampled. This pad is then stroked firmly over the sample surface, first vertically, then horizontally, to ensure complete coverage. The pad is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable surgical gloves, sampling personnel use a dedicated brush to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are sent to the laboratory for analysis.

### 4.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples should be stored out of direct sunlight to reduce photodegradation and shipped on ice (4°C) to the laboratory performing the analysis. Appropriately-sized, laboratory-cleaned, glass sample jars should be used for sample collection. The amount of sample required is determined in concert with the analytical laboratory.

### 4.4 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough porous surfaces which may be difficult to wipe, chip, or sweep.

### 4.5 EQUIPMENT/APPARATUS

- lab-clean sample containers of proper size and composition
- field and travel blanks
- site logbook
- sample analysis request forms
- chain of custody forms
- custody seals
- sample labels
- disposable surgical gloves
- sterile wrapped gauze pad (3 in. x 3 in.)
- appropriate pesticide (HPLC) grade solvent

- medium-sized, laboratory-cleaned paint brush
- medium-sized, laboratory-cleaned chisel
- autoclaved aluminum foil
- camera
- hexane (pesticide/HPLC grade)
- iso-octane
- distilled/deionized water

## 4.6 REAGENTS

Reagents are not required for preservation of chip, wipe or sweep samples. However, reagents will be utilized for decontamination of sampling equipment. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

## 4.7 PROCEDURES

### 4.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

### 4.7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per ERT SOP# 2006, Sampling Equipment Decontamination. It is then wrapped in cleaned,

autoclaved aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampling device should be used for only one sample.

1. Choose appropriate sampling points; measure off the designated area and photo document.
2. To facilitate later calculations, record surface area to be chipped.
3. Don a new pair of disposable surgical gloves.
4. Open a laboratory-cleaned chisel or equivalent sampling device.
5. Chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.
6. Place the sample in an appropriately-prepared sample container with a Teflon-lined cap.
7. Cap the sample container, attach the label and custody seal, and place in a double plastic bag. Record all pertinent data in the site logbook. Complete the sampling analysis request form and chain of custody form before taking the next sample.
8. Store samples out of direct sunlight and cool to 4°C.
9. Leave contaminated sampling device in the sampled material, unless decontamination is practical.
10. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

### 4.7.3 Wipe Sample Collection

Wipe sampling is accomplished by using a sterile gauze pad, adding a solvent in which the contaminant is most soluble, then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each gauze pad is used for only one wipe sample.

1. Choose appropriate sampling points; measure off the designated area and photo document.

2. To facilitate later calculations, record surface area to be wiped.
3. Don a new pair of disposable surgical gloves.
4. Open new sterile package of gauze pad.
5. Soak the pad with the appropriate solvent.
6. Wipe the marked surface area using firm strokes. Wipe vertically, then horizontally to ensure complete surface coverage.
7. Place the gauze pad in an appropriately prepared sample container with a Teflon-lined cap.
8. Cap the sample container, attach the label and custody seal, and place in a double plastic bag. Record all pertinent data in the site logbook. Complete the sampling analysis request form and chain of custody form before taking the next sample.
9. Store samples out of direct sunlight and cool to 4°C.
10. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

#### 4.7.4 Sweep Sample Collection

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand-held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area and photo document.
2. To facilitate later calculations, record the surface area to be swept.
3. Don a new pair of disposable surgical gloves.
4. Sweep the measured area using a dedicated brush; collect the sample in a dedicated dust pan.
5. Transfer sample from dust pan to sample container.
6. Cap the sample container, attach the label and

custody seal, and place in a double plastic bag. Record all pertinent data in the site logbook. Complete the sampling analysis request form and chain of custody form before taking the next sample.

7. Store samples out of direct sunlight and cool to 4°C.
8. Leave contaminated sampling device in the sample material, unless decontamination is practical.
9. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

## 4.8 CALCULATIONS

Results are usually provided in mg/g,  $\mu\text{g/g}$  or another appropriate weight per unit weight measurement. Results may also be given in a mass per unit area.

## 4.9 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

- All data must be documented on standard chain of custody forms, field data sheets or within the site logbook.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

The following specific quality assurance activities apply to wipe samples:

- A blank should be collected for each sampling event. This consists of a sterile gauze pad, wet with the appropriate solvent, and placed in a prepared sample container. The blank will help identify potential introduction of contaminants via

the sampling methods, the pad, solvent or sample container.

- Spiked wipe samples can also be collected to better assess the data being generated. These are prepared by spiking a piece of foil of known area with a standard of the analyte of choice. The solvent containing the standard is allowed to evaporate, and the foil is wiped in a manner identical to the other wipe samples.

Specific quality assurance activities for chip and sweep samples should be determined on a site-specific basis.

#### **4.10 DATA VALIDATION**

Review the quality control samples and use the data to qualify the environmental results.

#### **4.11 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

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## 5.0 WASTE PILE SAMPLING: SOP #2017

### 5.1 SCOPE AND APPLICATION

The objective of this Standard Operating Procedure (SOP) is to outline the equipment and methods used in collecting representative samples from waste piles, sludges or other solid or liquid waste mixed with soil.

### 5.2 METHOD SUMMARY

Stainless steel shovels or scoops should be used to clear away surface material before samples are collected. For samples at depth, a decontaminated auger may be required to advance the hole, then another decontaminated auger used for sample collection. For a sample core, thin-wall tube samplers or grain samplers may be used. Near surfaces samples can be collected with a clean stainless steel spoon or trowel.

All samples collected, except those for volatile organic analysis, should be placed into a Teflon-lined or stainless steel pail and mixed thoroughly before being transferred to an appropriate sample container.

### 5.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is generally not recommended. Refrigeration to 4°C is usually the best approach, supplemented by a minimal holding time.

Wide mouth glass containers with Teflon-lined caps are typically used for waste pile samples. Sample volume required is a function of the analytical requirements and should be specified in the work plan.

### 5.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are several variables involved in waste sampling, including shape and size of piles,

compactness, and structure of the waste material. Shape and size of waste material or waste piles vary greatly in areal extent and height. Since state and federal regulations often require a specified number of samples per volume of waste, size and shape must be used to calculate volume and to plan for the correct number of samples. Shape must also be accounted for when planning physical access to the sampling point and when selecting the appropriate equipment to successfully collect the sample at that location.

Material to be sampled may be homogeneous or heterogeneous. Homogeneous material resulting from known situations may not require an extensive sampling protocol. Heterogeneous and unknown wastes require more extensive sampling and analysis to ensure the different components are being represented.

The term "representative sample" is commonly used to denote a sample that has the properties and composition of the population from which it was collected, in the same proportions as found in the population. This can be misleading unless one is dealing with a homogenous waste from which one sample can represent the whole population.

The usual options for obtaining the most "representative sample" from waste piles are simple or stratified random sampling. Simple random sampling is the method of choice unless (1) there are known distinct strata; (2) one wants to prove or disprove that there are distinct strata; or (3) one is limited in the number of samples and desires to minimize the size of a "hot spot" that could go unsampled. If any of these conditions exist, stratified random sampling would be the better strategy.

This strategy, however, can be employed only if all points within the pile can be accessed. In such cases, the pile should be divided into a three-dimensional grid system; the grid sections assigned numbers; and the sampling points chosen using random-number tables or random-number generators. The only exceptions to this are situations in which representative samples cannot be collected safely or where the investigative team is trying to determine worst-case conditions.

If sampling is limited to certain portions of the pile, a statistically based sample will be representative only of that portion, unless the waste is homogenous.

## 5.5 EQUIPMENT/APPARATUS

Waste pile solids include powdered, granular, or block materials of various sizes, shapes, structure, and compactness. The type of sampler chosen should be compatible with the waste. Samplers commonly used for waste piles include: stainless steel scoops, shovels, trowels, spoons, and stainless steel hand augers, sampling triers, and grain samplers.

Waste pile sampling equipment check list:

- sampling plan
- maps/plot plan
- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- extension rods
- T-handle
- thin-wall tube sampler
- sampling trier
- grain sampler

## 5.6 REAGENTS

No chemical reagents are used for the preservation of waste pile samples; however, decontamination solutions may be required. If decontamination of equipment is required, refer to ERT Standard Operating Procedure (SOP) #2006, Sampling Equipment Decontamination, and the site-specific work plan.

## 5.7 PROCEDURES

### 5.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes or flagging to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminants, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

### 5.7.2 Sample Collection

#### **SAMPLING WITH SHOVELS AND SCOOPS**

Collection of samples from surface portions of the pile can be accomplished with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

Accurate, representative samples can be collected with this procedure depending on the care and

precision demonstrated by sample team members. Use of a flat, pointed mason trowel to cut a block of the desired material can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with implements such as garden trowels.

Use the following procedure to collect surface samples:

1. Carefully remove the top layer of material to the desired sample depth with a precleaned spade.
2. Using a precleaned stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of material from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### **SAMPLING WITH AUGERS AND THIN-WALL TUBE SAMPLERS**

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Figure 13, Appendix B). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the pile at the completion depth. The system is withdrawn

and the core collected from the thin-wall tube sampler.

Several augers are available. These include: bucket, continuous flight (screw), and post hole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete waste pile column is desired. Post hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy areas.

Use the following procedure for collecting waste pile samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
2. Clear the area to be sampled of any surface debris. It may be advisable to remove the first 3 to 6 inches of surface material for an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated materials onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.
5. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the pile. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.



7. Remove the tube sampler, and unscrew the drill rods.
  8. Remove the cutting tip and the core from device.
  9. Discard the top of the core (approximately 1-inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
  10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
  11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
2. Rotate the trier once or twice to cut a core of material.
  3. Slowly withdraw the trier, making sure that the slot is facing upward.
  4. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are being collected, place samples from the other sampling intervals into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### **SAMPLING WITH A GRAIN SAMPLER**

The grain sampler (Figure 15, Appendix B) is used for sampling powdered or granular wastes or materials in bags, fiberdrums, sacks, similar containers or piles. This sampler is most useful when the solids are no greater than 0.6 cm (1/4 inch) in diameter.

This sampler consists of two slotted telescoping brass or stainless steel tubes. The outer tube has a conical, pointed tip at one end that permits the sampler to penetrate the material being sampled. The sampler is opened and closed by rotating the inner tube. Grain samplers are generally 61 to 100 cm (24 to 40 inch) long by 1.27 to 2.54 cm (1/2 to 1 inch) in diameter and are commercially available at laboratory supply houses.

Use the following procedures to collect waste pile samples with a grain sampler:

### **SAMPLING WITH A TRIER**

This system consists of a trier and a "T" handle. The auger is driven into the waste pile and used to extract a core sample from the appropriate depth.

Use the following procedure to collect waste pile samples with a sampling trier:

1. Insert the trier (Figure 14, Appendix B) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes spillage of the sample. Extraction of the samples might require tilting of the sample containers.
1. With the sampler in the closed position, insert it into the granular or powdered material or waste being sampled from a point near a top edge or corner, through the center, and to a point diagonally opposite the point of entry.

2. Rotate the sampler inner tube into the open position.
3. Wiggle the sampler a few times to allow material to enter the open slots.
4. With the sampler in the closed position, withdraw it from the material being sampled.
5. Place the sampler in a horizontal position with the slots facing upward.
6. Rotate the outer tube and slide it away from the inner tube.
7. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

## **5.8 CALCULATIONS**

This section is not applicable to this SOP.

## **5.9 QUALITY ASSURANCE/ QUALITY CONTROL**

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **5.10 DATA VALIDATION**

This section is not applicable to this SOP.

## **5.11 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

**APPENDIX A**  
**Drum Data Sheet Form**

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# Drum Data Sheet Form

SOP #2009

Drum ID#: \_\_\_\_\_

Date Sampled: \_\_\_\_\_

Estimated Liquid Quantity: \_\_\_\_\_

Time: \_\_\_\_\_

Grid Location: \_\_\_\_\_

Staging Location: \_\_\_\_\_

Sampler's Name: \_\_\_\_\_

Drum Condition: \_\_\_\_\_

Sampling Device: \_\_\_\_\_

Physical Appearance of the Drum/Bulk Contents: \_\_\_\_\_

Odor: \_\_\_\_\_

Color: \_\_\_\_\_

pH: \_\_\_\_\_ % Liquid: \_\_\_\_\_

Laboratory Analytical Data: \_\_\_\_\_ Date of Analysis: \_\_\_\_\_

Compatibility: \_\_\_\_\_

Hazard: \_\_\_\_\_

Waste ID: \_\_\_\_\_

Treatment Disposal Recommendations: \_\_\_\_\_

## Approval

Lab: \_\_\_\_\_

Date: \_\_\_\_\_

Site Manager: \_\_\_\_\_

Date: \_\_\_\_\_

\* Area of site where drum was originally located.

Based on di Napoli, 1982. Table originally printed in the Proceedings of the National Conference on Management of Uncontrolled Hazardous Waste Sites, 1982. Available from Hazardous Materials Control Research Institute, 9300 Columbia Blvd., Silver Spring, MD 20910.

## APPENDIX B

Figures

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Figure 1: Universal Bung Wrench

SOP #2009

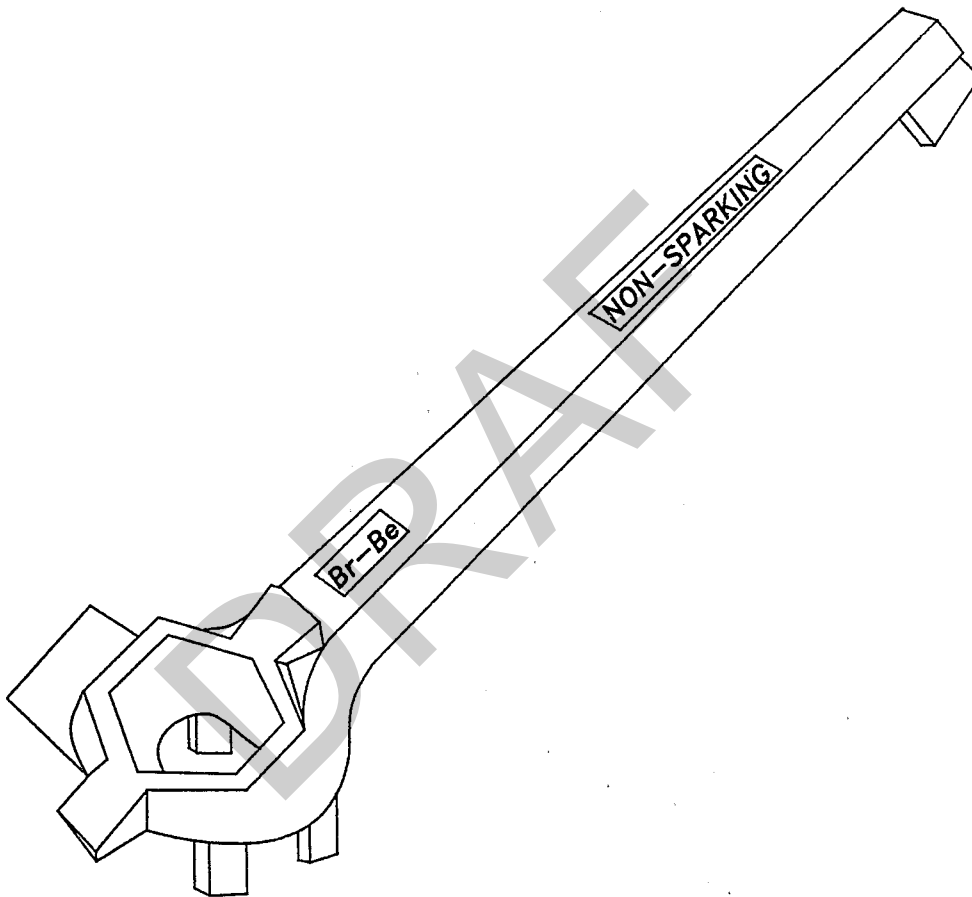


Figure 2: Drum Deheader

SOP #2009

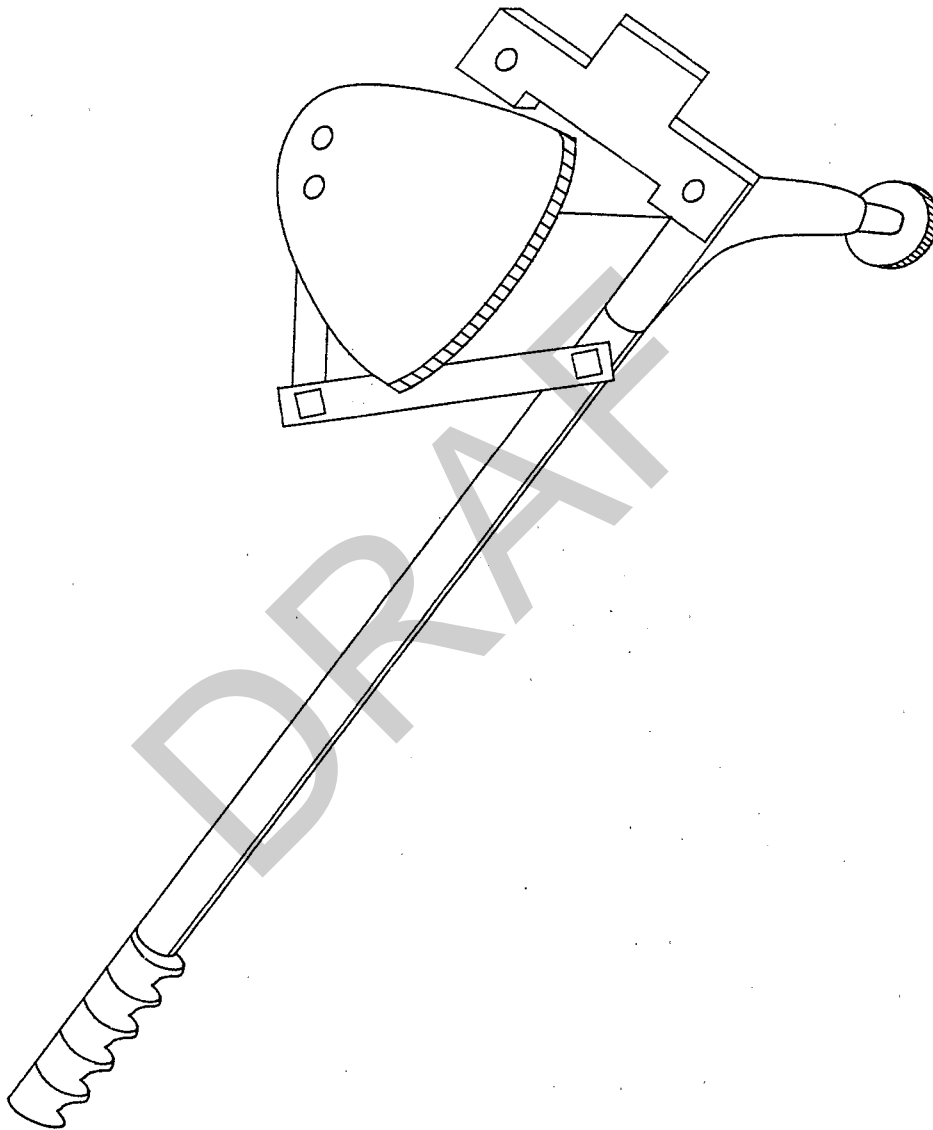


Figure 3: Hand Pick, Pickaxe, and Hand Spike

SOP #2009

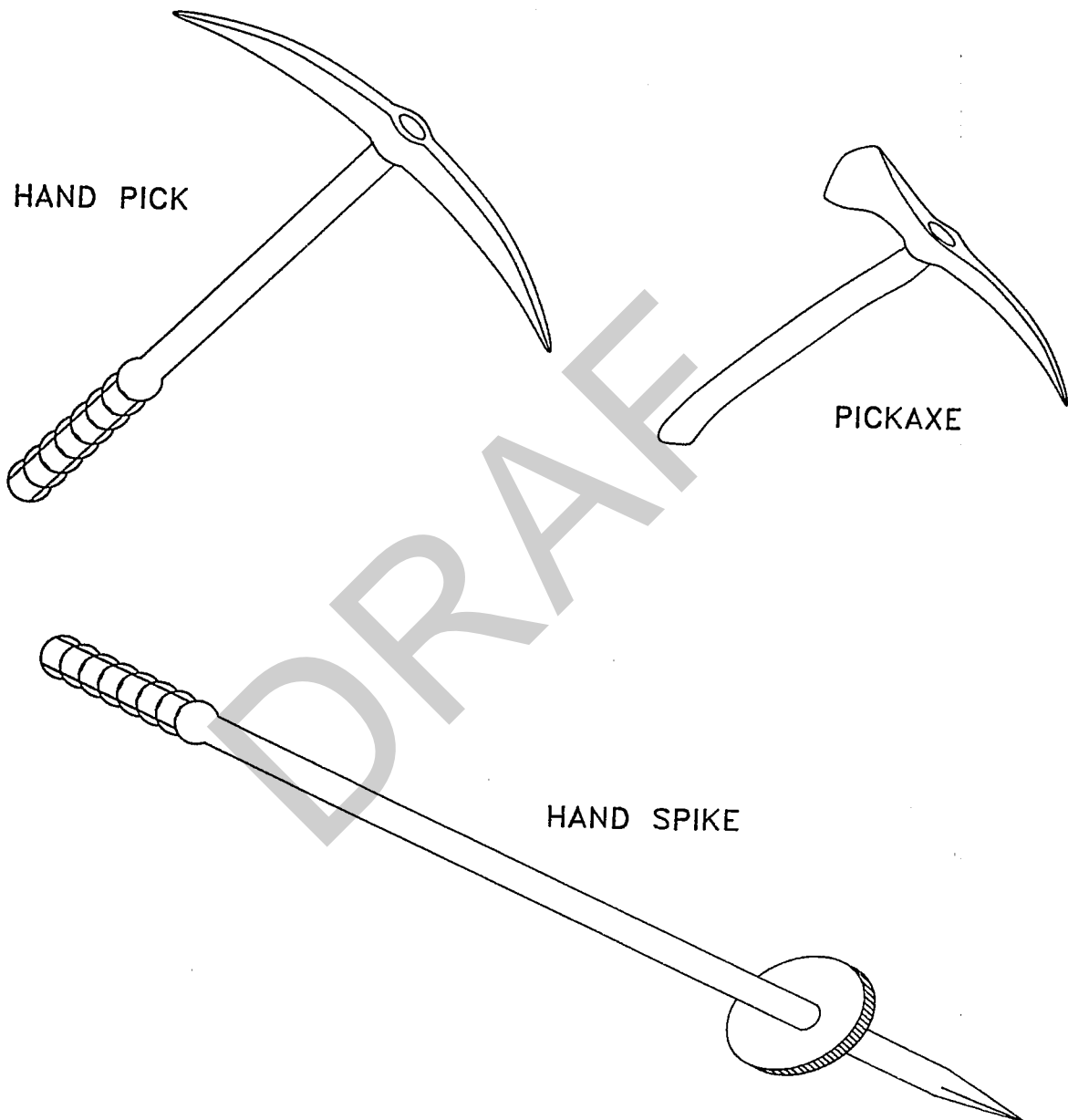




Figure 4: Backhoe Spike

SOP #2009

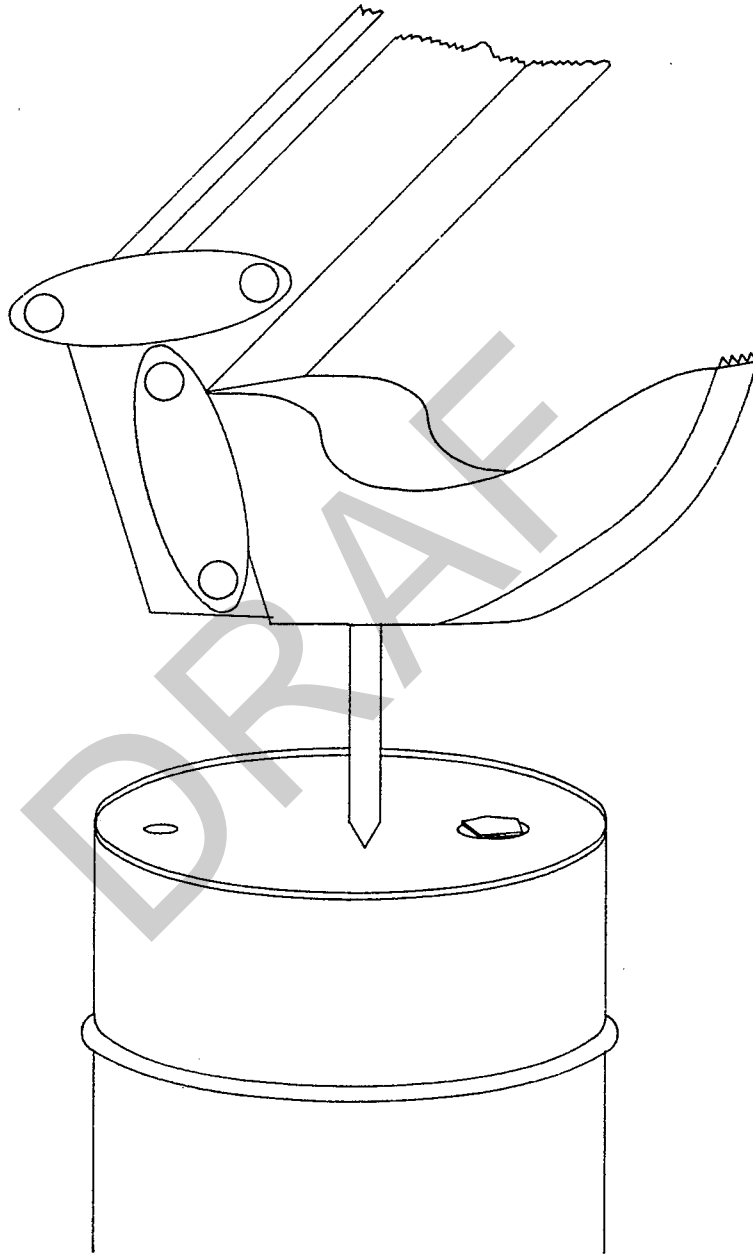


Figure 5: Hydraulic Drum Opener

SOP #2009

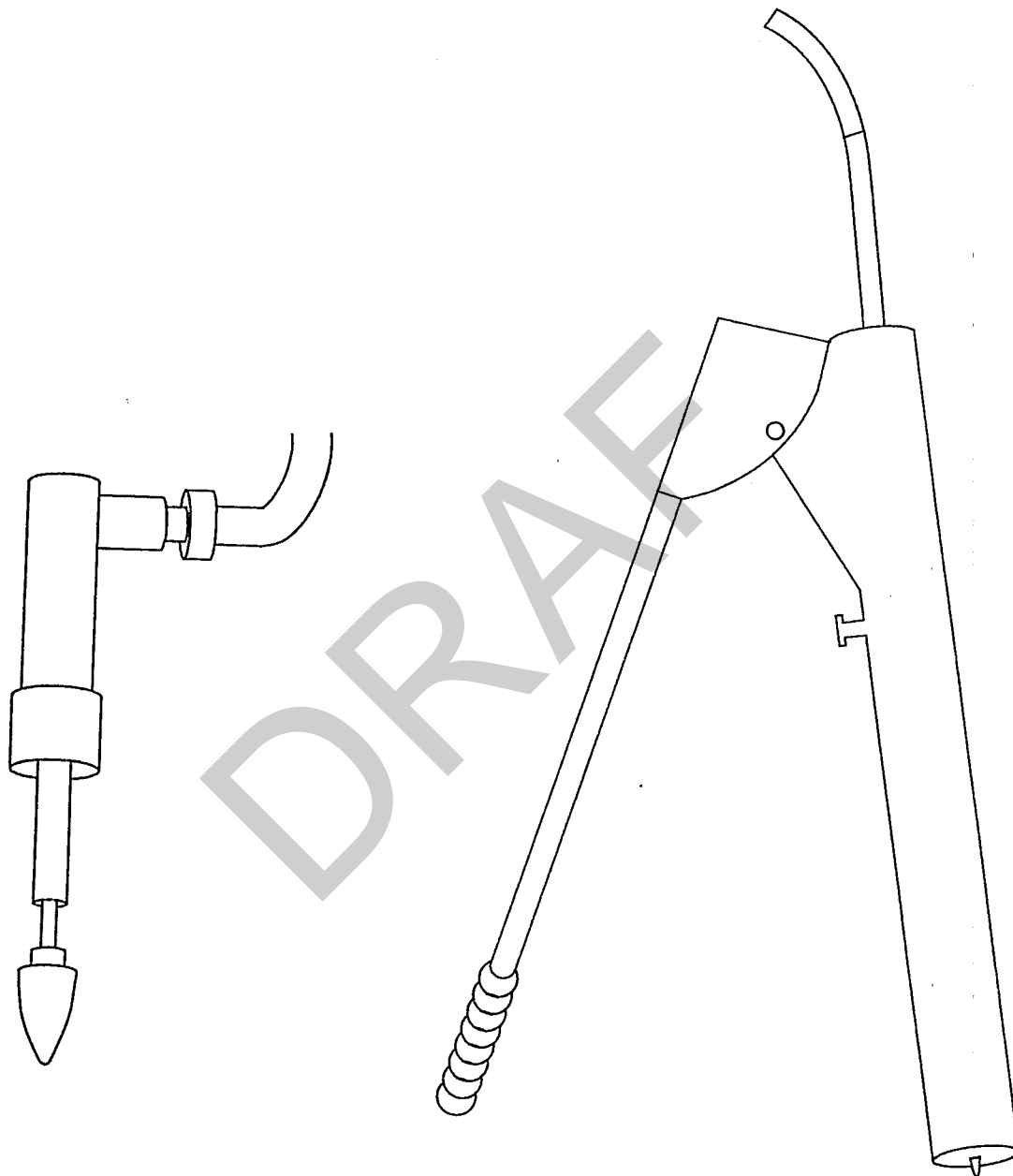
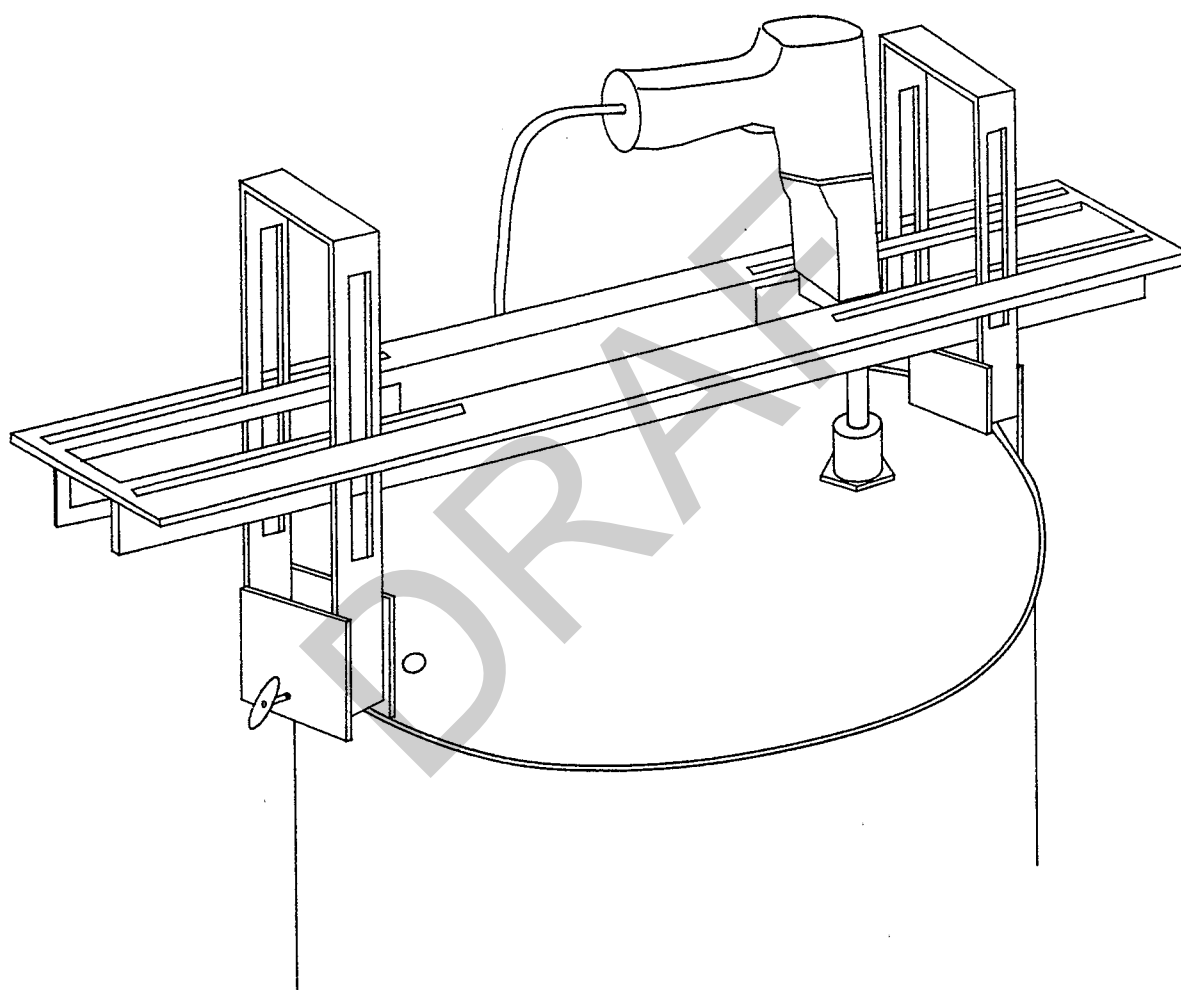


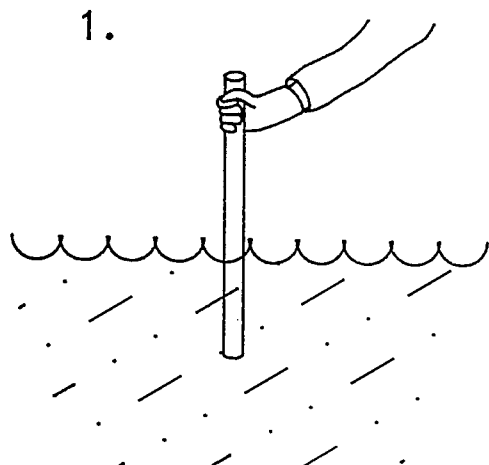
Figure 6: Pneumatic Bung Remover

SOP #2009

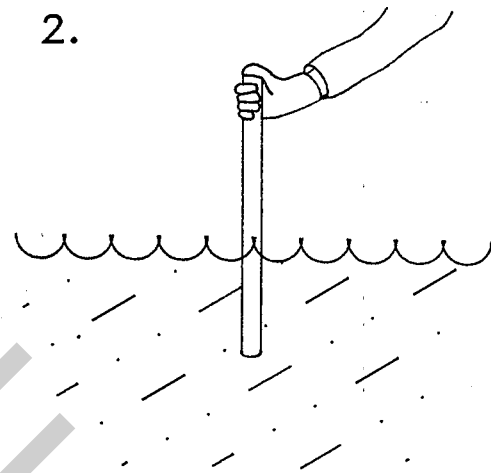


## Figure 7: Glass Thief

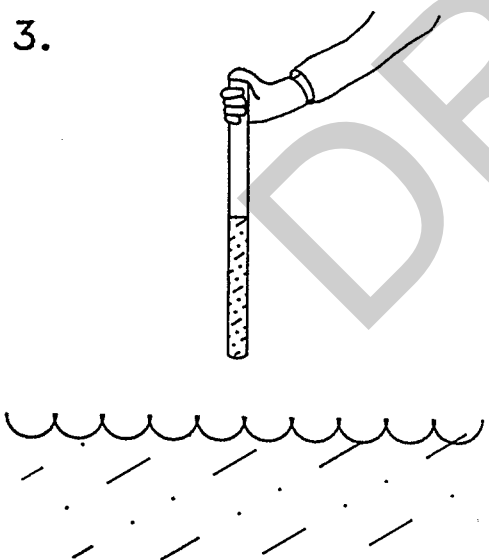
SOP# 2009



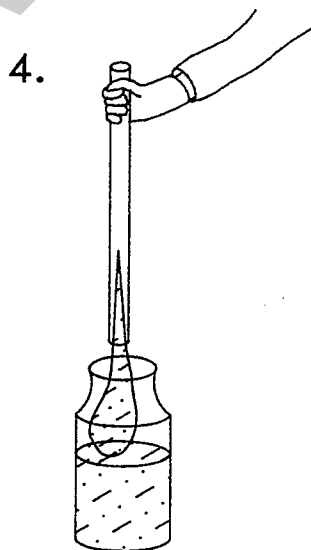
Insert open tube (thief) sampler in containerized liquid.



Cover top of sampler with gloved thumb.



Remove open tube (thief) sampler from containerized liquid.



Place open tube sampler over appropriate sample bottle and remove gloved thumb.

Figure 8: COLIWASA

SOP #2009

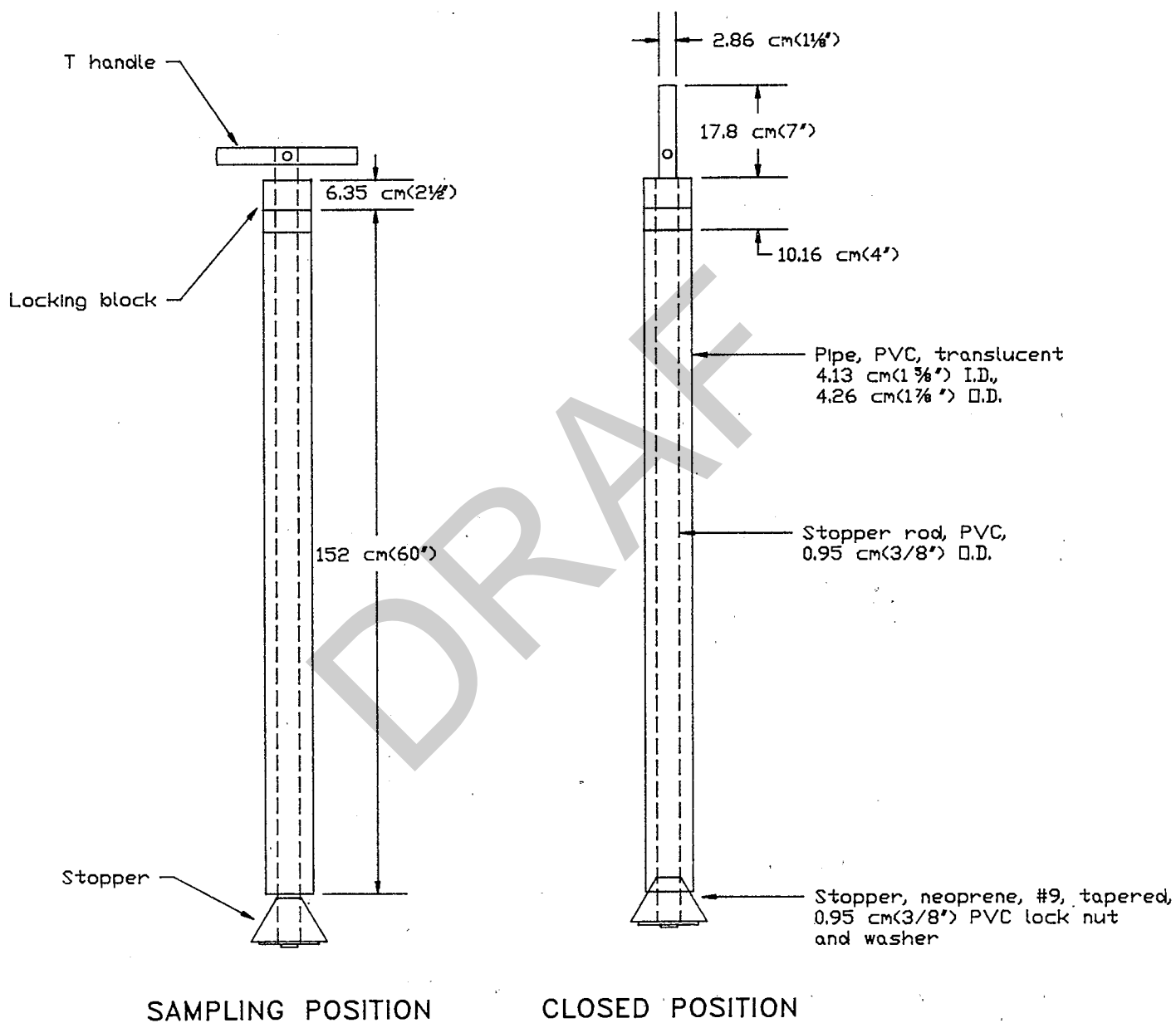


Figure 9: Bacon Bomb Sampler

SOP #2010

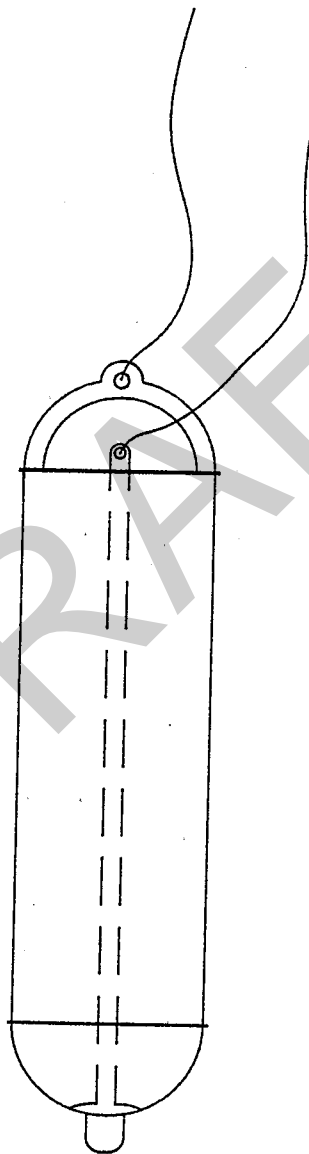


Figure 10: Sludge Judge

SOP #2010

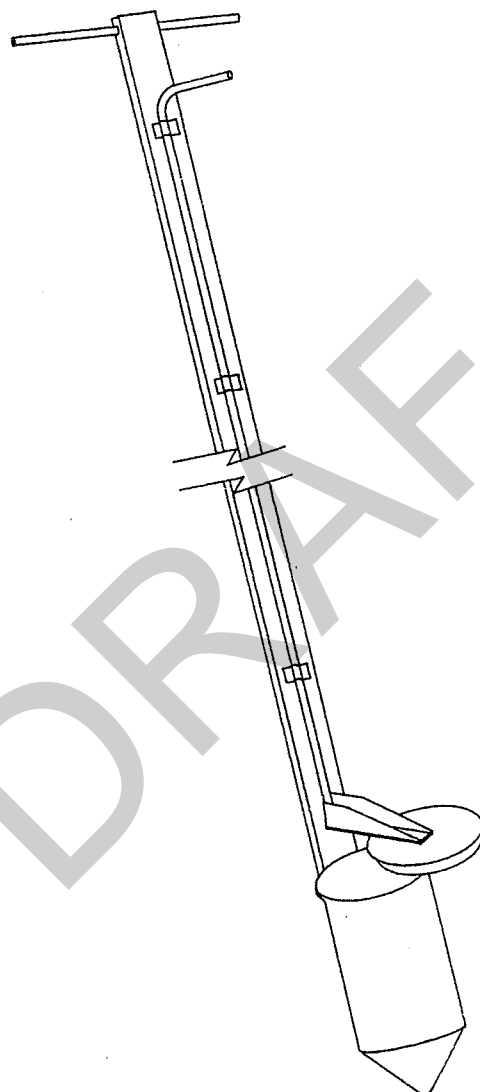


Figure 11: Subsurface Grab Sampler

SOP #2010

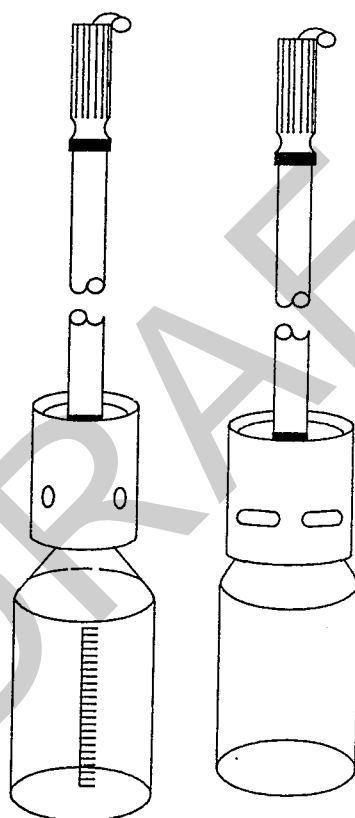




Figure 12: Bailer

SOP #2010

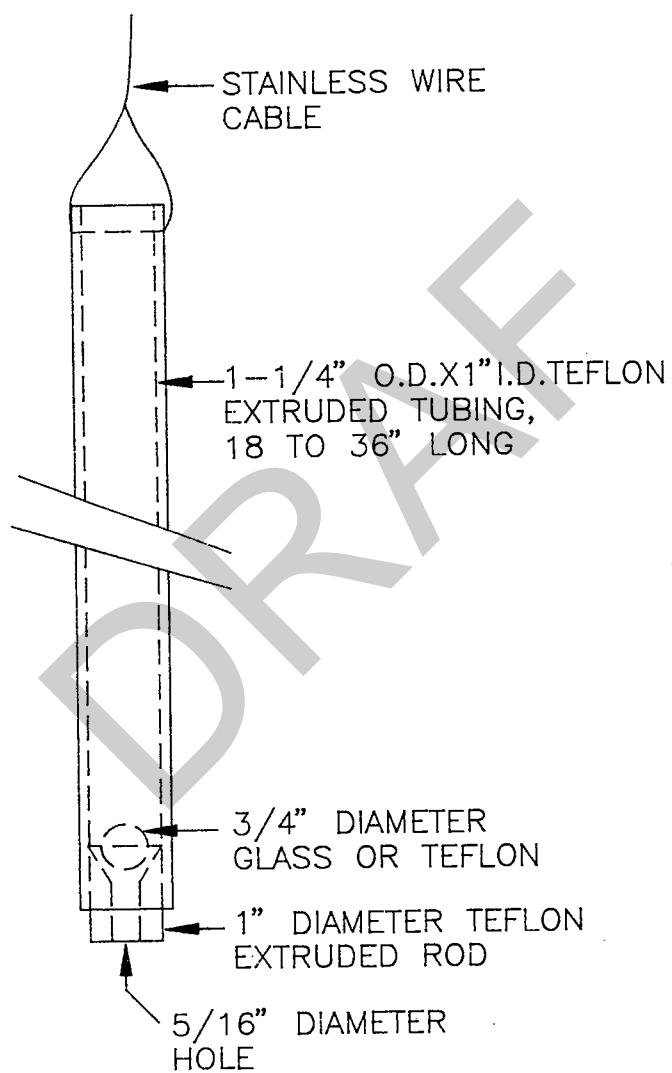


Figure 13: Sampling Augers

SOP #2017

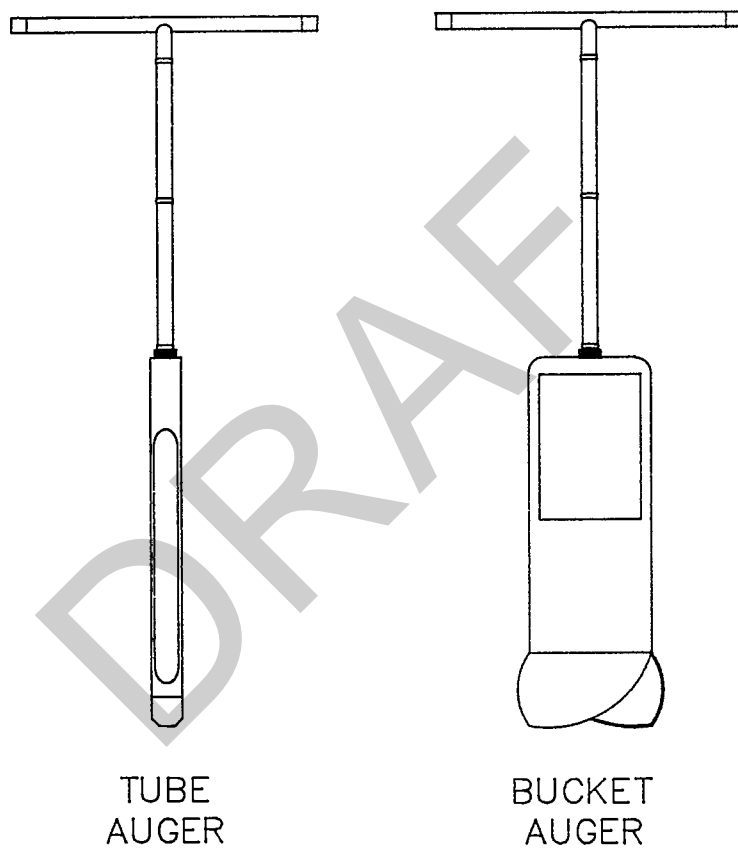


Figure 14: Sampling Trier

SOP #2017

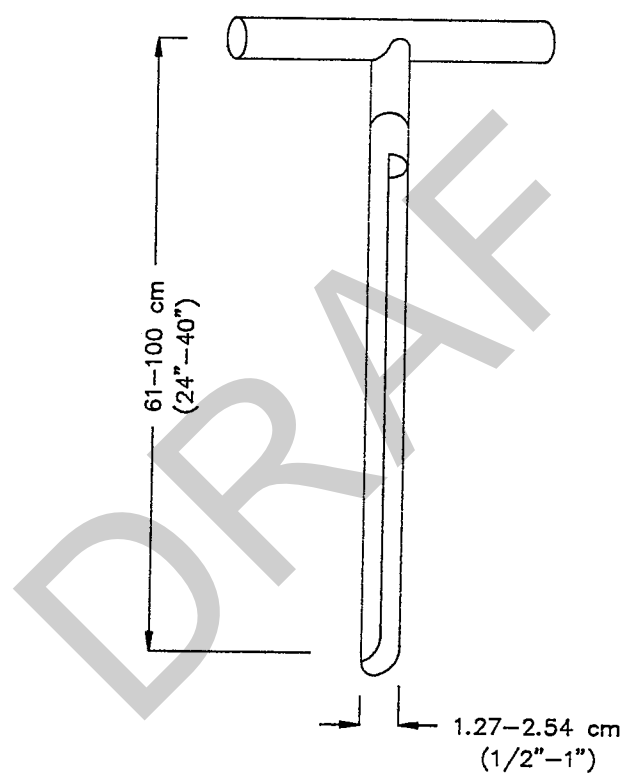
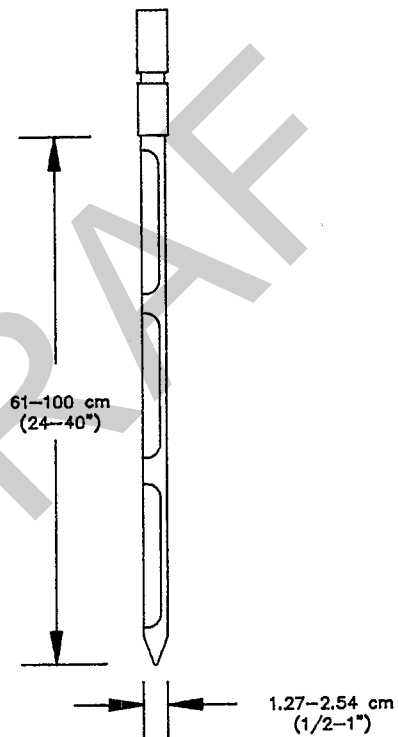


Figure 15: Grain Sampler

SOP #2017



## APPENDIX C

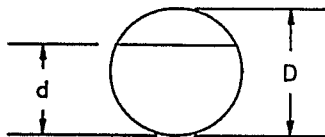
### Calculations

DRAFT

# Various Volume Calculations

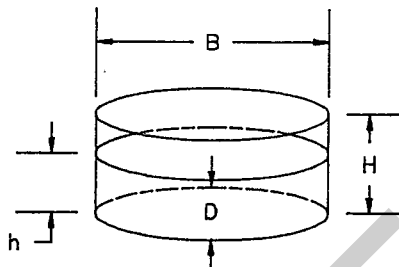
SOP #2010

## SPHERE



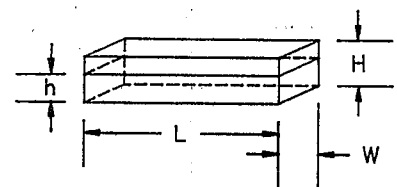
Total Volume  
 $V = \frac{1}{6} \pi D^3 = 0.523498 D^3$   
 Partial Volume  
 $V = \frac{1}{3} \pi d^2 (3/2 D - d)$

## ELLIPTICAL CONTAINER



Total Volume  
 $V = \pi B D H$   
 Partial Volume  
 $V = \pi B D h$

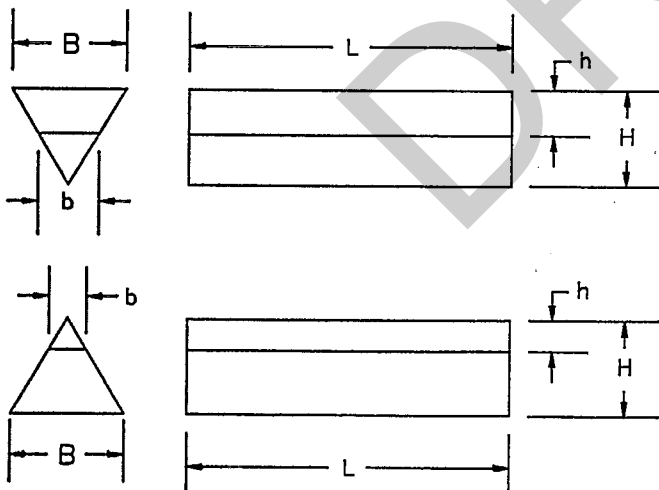
## ANY RECTANGULAR CONTAINER



Total Volume  
 $V = H L W$   
 Partial Volume  
 $V = h L W$

## TRIANGULAR CONTAINER

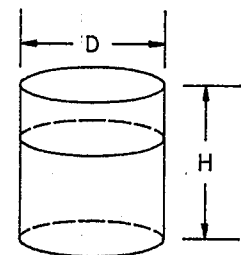
Total Volume  
 $V = \frac{1}{2} H B L$



Case 1  
 Partial Volume  
 $V = \frac{1}{2} h B L$

Case 2  
 Partial Volume  
 $V = \frac{1}{2} L (H B - h B)$

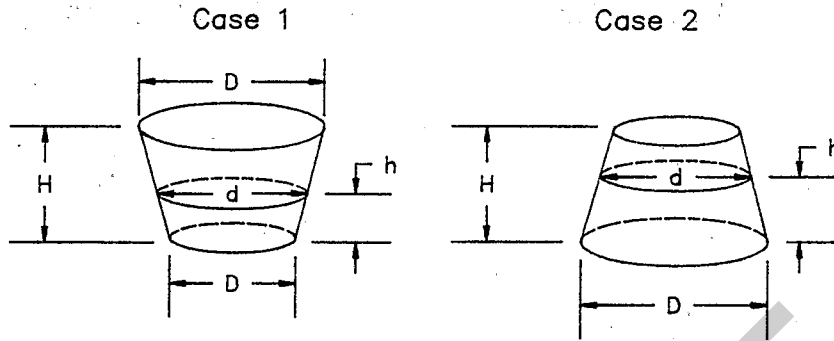
## RIGHT CYLINDER



Total Volume  
 $V = \frac{1}{4} \pi D^2 H$   
 Partial Volume  
 $V = \frac{1}{4} \pi D^2 h$

## Various Volume Calculations (Cont'd)

### FRUSTUM OF A CONE



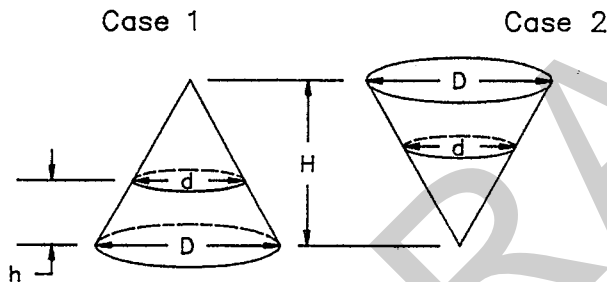
Total Volume

$$V = \pi/12 H(D_1^2 + D_1 D_2 + D_2^2)$$

Partial Volume

$$V = \pi/12 h(D_1^2 + D_1 d + d^2)$$

### CONE



Total Volume

$$V = \pi/12 \cdot D^2 H$$

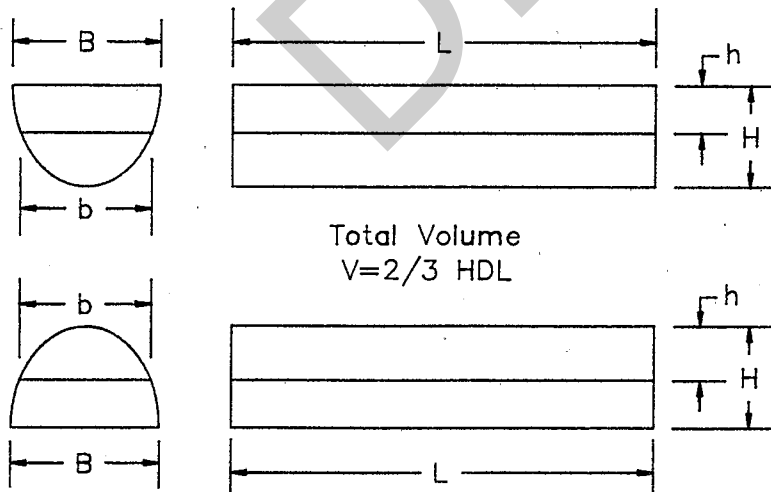
Partial Volume Case 1

$$V = \pi/12 \cdot d^2 h$$

Partial Volume Case 2

$$V = \pi/12 \cdot (D^2 H - d^2 h)$$

### PARABOLIC CONTAINER



Total Volume  
 $V = 2/3 HDL$

Case 1

Partial Volume

$$V = 2/3 h d L$$

Case 2

Partial Volume

$$V = 2/3 (HD - h d) \cdot L$$

## References

- Illuminating Engineers Society. 1984. IES Lighting Handbook. New York, NY. eds. John E. Kaufman and Jack Christensen. (2 volumes).
- National Institute for Safety and Health. October 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.
- New Jersey Department of Environmental Protection, Division of Hazardous Site Mitigation. 1988. Field Sampling Procedures Manual.
- U.S. EPA. 1985. Guidance Document for Cleanup of Surface Tank and Drum Sites. OSWER Directive 9380.0-3. NTIS Ref: PB-87-110-72.
- U.S. EPA. 1986. Drum Handling Practices at Hazardous Waste Sites. EPA/600/2-86/013.
- U. S. EPA/Region IV, Environmental Services Division. April 1, 1986. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual. Athens, Georgia.
- U.S. EPA/OSWER. November, 1986. Test Methods for Evaluating Solid Waste, Third Edition, Vol. II, Field Manual. EPA Docket SW-846.
- U.S. EPA. 1987. A Compendium of Superfund Field Operations Methods. EPA/540/5-87/001. Office of Emergency and Remedial Response. Washington, D.C. 20460.